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Report on

FISHERIES DEVELOPMENT AND REQUIREMENTS OF FISHERY EDUCATION AND TRAINING IN MALAYSIA, THAILAND, FIJI AND THE PHILIPPINES

With particular reference to the artisanal sector

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1973

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FISHERIES DEVELOPMENT AND REQUIREMENTS OF FISHERY EDUCATION AND TRAINING IN MALAYSIA, THAILAND, FIJI AND THE PHILIPPINES WITH PARTICULAR REFERENCE TO THE ARTISANAL SECTOR

by

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1973

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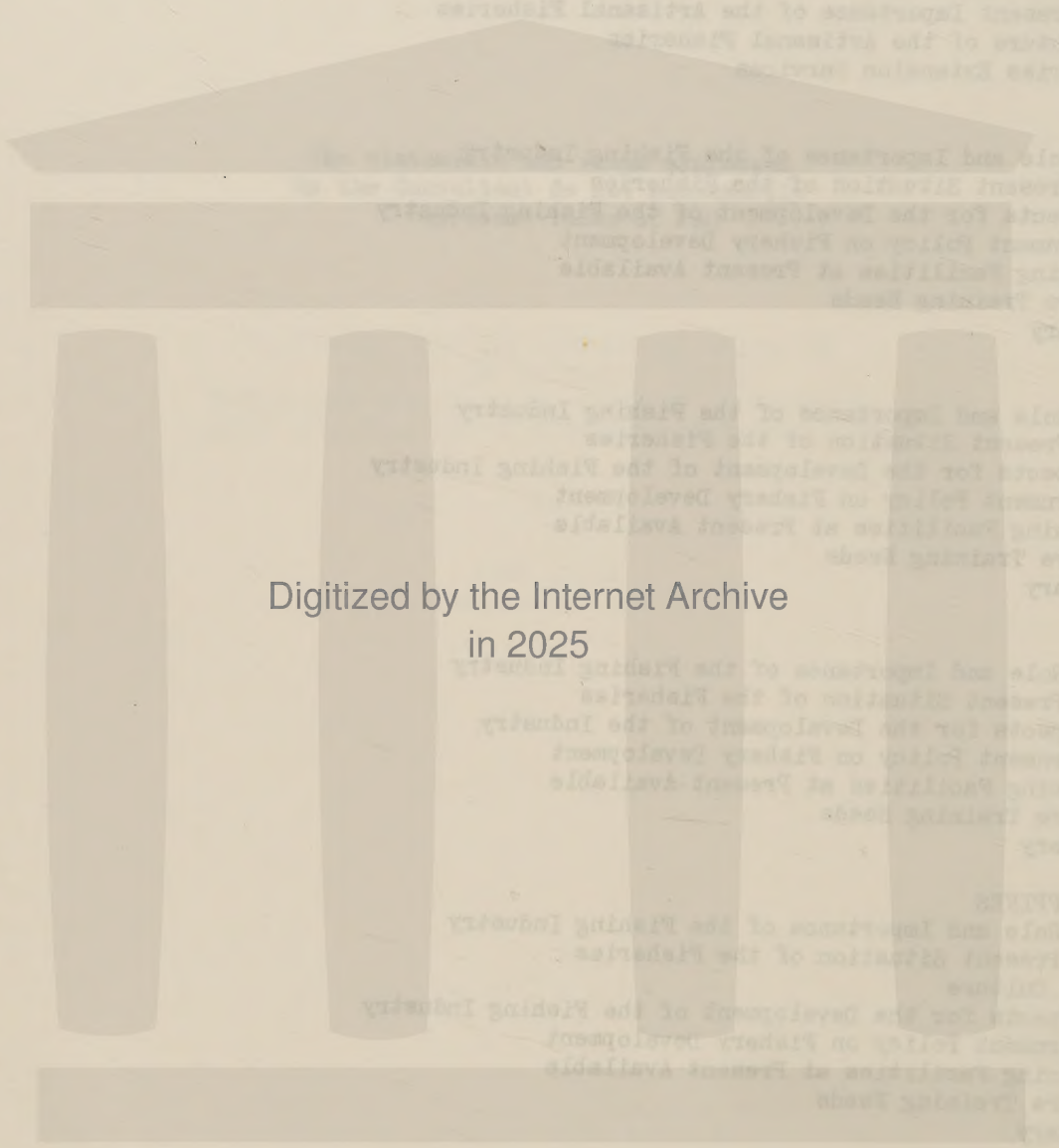

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INTRODUCTION

This report is based on information obtained during an eight week study tour from 25 February to 16 April 1973. My itinerary was as follows:

Rome - 25 February to 2 March
West Malaysia - 3 to 19 March
The Philippines - 20 to 30 March
Fiji - 1 to 6 April
Thailand - 7 to 14 April
Rome - 16 April

Scope of the study

The FAO Department of Fisheries proposed the following outline for the study:

(i) Present situation of artisanal fisheries and the requirements for training of artisanal fishermen.

(ii) Government policy on fishery development with particular reference to the artisanal sector.

(iii) Government measures taken and being taken to develop or improve the artisanal fishery sector. External assistance received or expected to be given for the artisanal sector.

(iv) Fishery extension service:

(a) present organization, financing, scope of activities and extension methods;
(b) extension staff (qualifications and training of extension workers).

(v) Suggestions regarding steps which might be taken with a view to meeting training requirements in the artisanal fishery sector:

(a) regarding financing, organization and practices of extension service;
(b) regarding training of extension workers;
(c) others.

So far as possible this outline has been followed in reporting on the countries visited but all the subjects proposed are not, of course, applicable in every country. Basic fisheries data for the countries studied have not been produced here. For such details refer to the Fishery Country Profiles (4, 5, 7 and 9).

The phrase "artisanal fisheries" calls for some explanation since this term is not so commonly used in English as is the equivalent phrase in French. Everyone connected with the fishing industries has a fairly clear idea of the meaning of the phrase but no one finds it easy to give a brief definition. Thus, in a paper (1) prepared for the COFI meeting in 1952, FAO noted: "While it is generally agreed that artisanal fisheries comprise the largest single sector in world fisheries in the number of people employed - FAO estimates that of the 10.2 million fishermen in the world 9 million are in developing countries almost all of whom can be classified as artisanal fishermen - there is no general agreement as to what is an artisanal fishery because conditions and situations differ from country to country. However, some attempt at a definition is desirable for this paper so long as it is understood to be of a flexible and pragmatic nature and that each country must, in the final analysis, define its own artisanal fisheries. Artisanal fishermen may be found in coastal, estuary, lagoon, river or lake fisheries, including aquaculture. The capital investment is relatively slight, with a corresponding low level of organization and with little use of specialized skills. Vessels are small and the fishing gear is usually hand-operated. Productivity and incomes are generally low with the catch commonly sold fresh or salted, dried, or smoked for local sale. The fishery lacks infrastructural backing and credit."

In the present study the artisanal fisheries include those fisheries in which the fishermen operate in inshore waters working from open- or small-decked boats and generally returning to their base within 24 h of setting out on a fishing trip. In most cases the boats would be owner-operated but this is not an invariable rule, one working fisherman may own more than one boat and some very small craft are owned by people who do not go to sea. In some cases boats which commonly keep the sea for more than 24 h at a time must be included. Examples would include small handline vessels in which the catch is salted down for later drying ashore, and gillnet and trap boats in which the catch is iced down and held for a week or more before landing; some of the smaller trawlers and longliners should also be included. Almost all present aquaculture operations are on such a small scale as to demand their inclusion.

The artisanal fisheries are thus almost synonymous with the peasant fisheries of Firth (2) and the small scale fisheries of Proude (3) but must also include culture operations where these are one-man or small-group enterprises. Thus, at one end of the fisheries spectrum, the artisanal fisheries shade into the subsistence fisheries in which a man fishes solely to provide food for his own family and at the other end into the enterprise, company or commercial fisheries in which bigger vessels, keeping the sea for at least several days at a time, are employed. Such vessels are more commonly owned by companies rather than by individuals and are seldom owner-operated. Therefore, the tuna longline fisheries and the larger trawlers, purse seiners and bagnet boats have been regarded as being clearly outside the scope of this study. Such fisheries could not, however, be entirely ignored since in some cases at least they operate, or wish to operate, on the same fishing grounds as the artisanal fishermen; they may draw on the artisanal fisheries for some of their operatives and their landings may affect the marketability of fish taken or produced in the artisanal fisheries.

The present importance of the artisanal fisheries

Since it is difficult to accurately define the artisanal fisheries it is even more difficult to say how many people earn their livelihood from these fisheries or how much they produce annually. The number of artisanal fishermen is certainly substantial in Malaysia, Thailand and The Philippines and all fishermen of Fiji may be so classified.

The number of people supported by the artisanal fisheries is, of course, much larger than the number of people actually engaged in these fisheries. Only very rough calculations can be offered to suggest how large these numbers may be. One clue is given by the Census of Marine Fisheries in Thailand 1967 (6) where the average number of family members per household is given as 6.2 and the average number per household actually engaged in marine fishing is 1.5. This suggests that in Thailand each fisherman has on average about 3 dependants, in other words, multiplying the number of fishermen by 4 gives a very rough estimate of the number of people supported by the fishing side of the industry. In countries where the family size is known to be relatively large, and a substantial proportion of the total population in the younger age groups, this could well be an underestimate. If we accept the multiplication factor as giving a figure of at least the correct order of magnitude for Thailand and also assume, as seems reasonable, that a similar factor can be used in the other countries we conclude that the number of people supported by the marine sector of the artisanal fisheries would be of the order of 240 000 in Malaysia, 2 million in The Philippines, 2 million in Thailand and 8 000 in Fiji.

It is only in The Philippines and Thailand that substantial numbers of people are engaged in fish culture and few fish culturists in either country rely solely on this activity for their livelihood. If the culturists' families are of similar size to those of the fishermen and if half of their time is occupied with fish culture, this would suggest that these activities support the equivalent of some 300 000 people in The Philippines and a similar number in Thailand.

Thus if these estimates, based as they are on somewhat inadequate information, are even approximately correct, the artisanal fisheries provide a livelihood for substantial numbers

of people. The estimates for the numbers of people employed in the primary sector can be checked by reference to the number of fishing craft known to exist and so are in less doubt than the other figures suggested here. The primary sectors of the marine artisanal fisheries alone support some 2.3 percent of the population of Malaysia, 5.4 percent of the population of The Philippines, 0.6 percent of the population of Thailand and 1.5 percent of the population of Fiji.

In all the countries studied fish is the most important source of animal protein for the majority of the population.

The quality of the fish produced by the artisanal fisheries is at least as important to the national economies as the quantity. In Malaysia, Thailand and The Philippines a high proportion of the fish landed by the artisanal fisheries is of the more highly prized varieties including the mackerels, horse mackerels, pomfrets, snappers, groupers and, of course, shrimp. In Malaysia, The Philippines and Thailand they also produce virtually all of the molluscan shellfish which are important because they supply a cheap easily transported source of animal protein to the poorer sections of the community. In all three countries shrimp is of increasing importance as a means of earning foreign exchange. The evidence for the fact that these qualitatively important supplies are produced in the artisanal fisheries lies in the records of the types of fishing gears operated in these fisheries, not in the catch statistics, which do not in general offer any detail of the landings by species by the different sectors of the industries.

The trawl fisheries on the other hand produce a much greater proportion of the small low-grade fish. In The Philippines all is used for human consumption but in Thailand in 1971 35.2 percent of the trawl catch was trash fish which is either converted into fishmeal or used for duck and fish food (11). In Malaysia in 1970 17 percent of the total catch was converted into meal or used directly for animal feeding (4).

A further reason for saying that the artisanal fisheries are of importance in the national economies of the four countries is that they produce fish from shallow inshore waters such as, the estuaries, lagoons, mangrove areas and coral reefs where the use of larger vessels would be impractical or unprofitable or both.

The artisanal fisheries have also provided the pool of labour from which has been drawn the crews for the larger vessels which now form such an important element in the fishing industries of Thailand, Malaysia and The Philippines. If the trend in other parts of the world is reproduced here, one would expect to find that there will be constant interchange between the two sectors. Men who decide that for personal reasons such as, marriage or family considerations, long sea trips become unacceptable and men who find the offshore fisheries beyond their physical capabilities, move back into the artisanal fisheries where the financial rewards may be smaller but there are other compensations and young men who start in the artisanal fisheries move into the offshore fisheries.

The future of the artisanal fisheries

Since all of the countries under consideration are extending their fisheries activities into offshore waters using larger, more powerful vessels and more complicated and sophisticated techniques than those on which the traditional fisheries are based, it is quite reasonable to ask whether there is any future at all for the artisanal fisheries. The natural resources available to the fisheries are of course finite and every nation would wish to exploit the resources available to it to the best advantage of its nationals. In the long term this requires the use of the most efficient methods of harvest available; in the short term other considerations such as the need to promote maximum employment or to use existing skills and capital equipment may prevail.

In any fishery there is an optimum vessel size in terms of productivity per unit of capital invested. The optimum vessel size for the offshore fisheries in process of development or contemplated in the countries considered here may well prove to be larger than most

at present in use. In Thailand, for instance, the pattern of trawler development is fairly clear; while there has been an increase in the number of trawlers of all sizes between 1967 and 1970 the greatest increase has been in larger vessels (see Table 1). The larger vessels can operate further from base, keep the sea for longer periods and fish in weather which would limit the activities of the smaller vessels.

Table 1

Trawlers in use in Thailand 1967/70

Year	Number of trawlers (overall length in m)			
	25 m +	18–24 m	14–18 m	- 14 m
1967	0	318	701	713
1968	0	575	1 188	983
1969	0	499	1 086	870
1970	67	644	1 172	801

Source: Tiews, K. Fishery Development and Management in Thailand (10)

Unfortunately the facts which would be needed to calculate the relative profitability of vessels of different sizes are not readily available as different authorities quote the building costs of vessels of different sizes in five groupings while catches are elsewhere quoted in three groupings. No doubt it has been proven more profitable to operate the larger vessels.

It is interesting to note that, as would be expected, there has been a reduction in the number of fishing vessels and fishermen in Thailand over the same period. The number of powered vessels has increased while the number of non-powered vessels has decreased (Table 2).

Table 2

	1967	1970	1970 figure as a percentage of 1967
Fishermen	75 676	74 086	97.9
Non-powered boats	14 710	8 313	56.5
Powered boats	18 871	19 208	101.8
Total boats	33 581	27 521	82.0

Source: Department of Fisheries, Thailand 1972. Country Paper on Thailand FIE:FET/72/Cp38, FAO, Rome (23)

Similar trends are apparent in Malaysia, between 1957 and 1967 the number of fishing boats decreased from 23 824 to 20 236 in West Malaysia, the number of inboard engined boats increasing from 1 541 to 10 145 and outboard engined boats decreasing from 4 742 to 2 887. By 1970 the West Malaysian fleet comprised just over 19 000 vessels, over 70 percent of which were motorized, the majority using inboard engines. The increase in inboard engined vessels and in their average size has led to a reduction in the numbers of fishermen. Though somewhat less well documented, a similar process is taking place in The Philippines and Fiji also plans to use larger boats than at present.

These trends to bigger vessels and reductions in numbers of fishermen might lead one to suppose that the artisanal fisheries will decline in importance and perhaps even disappear. There are other reasons, however, for believing that the artisanal fisheries will be of importance for the foreseeable future, and, in some respects of greater importance than at present.

All the countries under discussion have an unemployment or underemployment problem and all are experiencing population increases of the order of 3 percent per annum. All, thus, have good reasons for fostering activities which can provide a livelihood for substantial numbers of people and to improve the working and living conditions so as to make these activities more attractive and the people engaged in them more prosperous.

The artisanal fisheries which provide employment at a low level of capital input and can, if given advice and an adequate infrastructure, provide a good living, should obviously be encouraged. It is to be expected that increasing efficiency will bring about some reduction in the numbers of people involved in the marine fishing sector while the application of the results of recent and current research to culture activities will increase the numbers engaged in this sector. The overall result should be a reduction in the numbers involved.

Many of the fisheries resources in the inshore waters, estuaries, lagoons, mangrove areas and over reefs and mud flats can only be exploited by fishermen using small craft. Many of such fisheries are specialized and yield fish or shellfish of high value and in high demand. Maximum exploitation of these valuable resources requires not only the continuance but also the strengthening of the artisanal fisheries. In many cases these resources are to be found in rural areas where it is particularly desirable to provide job opportunities. The artisanal fisheries also provide a reserve of labour for the offshore fisheries and employment opportunities for men who, for one reason or another, wish to leave the offshore fisheries.

Evidence from countries which have well developed fisheries also suggests that the artisanal fisheries will be of continuing importance. Japan owns some of the largest fishing vessels in the world and these are to be found fishing in every ocean but, according to Yasueda (12) "in 1967 the numbers of fishing households and enterprises totalled 227 600 of which 218 000 or 95.2 percent were engaged in coastal fisheries. Those engaged in offshore and deep-sea operations numbered only 9 400". These figures refer to households, not to individual fishermen; the number of men actually engaged, particularly in the offshore and deep-sea fisheries is much greater than the number quoted. In the European countries which have developed offshore and distant water fisheries, and in North America, the artisanal fisheries continue to exist alongside the more capital-intensive ventures.

There are thus good grounds for supposing that the artisanal fisheries of Malaysia, The Philippines, Thailand and Fiji will be of continuing importance. If the people involved are to share in the increasing prosperity which development is bringing, then the artisanal fisheries will need to receive at least as much support and encouragement from the governments as other sectors of the community. Much of the remainder of this report will be concerned with suggestions as to how such support and encouragement might be provided, principally in providing education and training of one sort or another. Training could have a considerable impact, but what is required is an integrated effort to improve the income and living conditions of the artisanal fishermen and their dependants so that they can play a full part in national development. A prosperous artisanal fishery could be an important national asset, as is already the case in Japan.

The task of improving and strengthening the artisanal fisheries is not an easy one. Vast numbers of people are involved; they live in scattered, often isolated, communities where living conditions are difficult and facilities are lacking. The people are usually independent-minded individualists who will accept advice only from those who have earned their confidence and trust. The level of education is generally low, many are illiterate or barely literate. In some cases the people have sunk into an apathetic acceptance of their lot. There is some evidence, however, of an increasing awareness among these people that

other sections of the community have an easier life and are more prosperous. The increasing availability of the mass media will accelerate this learning process and governments should be prepared to take advantage of this increasing awareness of the possibilities for development and improvement.

The main courses of action required would be to set up extension services and to provide training for the officers who oversee and operate the services, to provide the funds needed both for the operation of the extension services and for the improvement of the infrastructure of the artisanal fisheries and to devise a means through which these latter funds can be channelled. In most instances loans to the fishermen for acquiring better boats, engines, fishing gear, etc., will also be needed.

Fisheries extension services

The most effective way to provide training for most fishermen and for fisheries operatives generally is undoubtedly to combine periods of academic and theoretical teaching in the classroom with periods of practical training in workshops or under other simulated or actual working conditions. This should be followed by training using the trainee's own equipment. Whenever possible the training should take place in a residential school so that tuition can be on a full-time basis and the process of learning intensified by the ready access to facilities which such a school can provide.

Only limited use can be made of such schools in the training of artisanal fishermen; the very numbers of people who could benefit from some form of training make the process impossibly expensive and time-consuming. The alternative of taking the teacher to the students is the only one possible. Since the essence of the idea is the extension of knowledge to the community the teacher is referred to as an extension worker and the arm of government to which he belongs as an extension service. Objections to the term "extension service" are sometimes voiced, preference being expressed for terms such as, "fisheries development service" and "fisheries improvement service". All are somewhat clumsy and, since the term extension is widely used and understood it should be preferred. The term seems to have arisen from the idea that the use of methodologies discovered by research and proved in experimental stations should be extended to practical field use. Certainly in some countries, as in parts of the U.S.A. the extension services for agriculture are operated by the universities involved in agricultural research and experiment.

According to Yasueda (12) the function of a fisheries extension service is to spread knowledge and techniques among fishermen with a view to modernizing the management of fishing enterprises, improving productivity and advancing the fishermen's standard of living. In the broadest sense the service is an educational project. He also says that in the past some people have had little opportunity to obtain an education and that experience in Japan has shown that widespread use of knowledge is essential for advance in the general standard of living. The fisheries extension service should, therefore, seek to make the widest possible use of available knowledge and new techniques for achieving higher efficiency in fishery production, helping fishermen, regardless of their level of education and experience and their families to adapt to modern socio-economic conditions.

MALAYSIA

In the time available for study, it was possible to visit only four states in West Malaysia, neither of the East Malaysian states was included in the tour. Thus, although references are made throughout this chapter to Malaysia, direct observations were made in West Malaysia only. It was, of course, possible to discuss conditions in East Malaysia with some officials.

On the east coast of West Malaysia, during the southwest monsoon from April to September, fishing conditions are almost uniformly good and relatively clam sea conditions prevail. During the northeast monsoon from November to March, high winds, torrential rains and rough seas restrict fishing activities. The east coast rivers are all shallow and the formation of

sand bars closes these to all but the most powerful shallow draft vessels for some weeks at a time every year. The west coast fishermen are more fortunate, the effects of the north-east monsoon are little felt, the torrential rains may cause some flooding but the sea rarely becomes too rough for fishing. The southwest monsoon is much less severe than the northeast monsoon, the southern states are protected by Sumatra from all but the worst effects and even in the northern states of Kedah and Perlis fishing activities are seldom reduced for more than a few days at a time. Thus, fishing continues the year round from the small harbours and rivers of the west coast but is very restricted and often quite impossible for some four months of the year on the east coast. Boats which manage to fish the South China Sea during the northeast monsoon experience good catches. An east coast fishing harbour which could be used during the northeast monsoon could thus make a very substantial contribution to improving the livelihood of the east coast fishermen.

The area of continental shelf to a depth of 200 m, which is theoretically available to the Malaysian fishing industry, has been estimated to be over 40 000 km^2. Fishing is, at present, restricted to a depth of about 50 m and few boats are equipped to fish beyond this depth. By no means has all the available area been adequately surveyed but it is known that there are untapped demersal resources.

Most fishermen live in rural rather than urban communities; conditions in many of the villages have been much improved in recent years. A rural electrification programme has brought electricity to all but the most remote communities and many villages have piped water supplies. Primary schooling is free and available to all, school buses ensure that almost all who need transport to and from school get it and medical and welfare standards are high. Communications are much better than in most southeast Asian countries; road surfaces are generally excellent there being an extensive system of main and secondary roads. There are, at present, three main trunk routes - route I from Singapore to Kuala Lumpur to Ipoh and Butterworth (for Penang) and on to Kangar on the Thai border; route II from Port Klang to Kuala Lumpur to Kuantan on the east coast; route III from Kuantan to Kota Bahru. A new east-west highway to provide a country link from Kelantan to Penang is under construction. Fish distribution is thus easy and iced fish is available throughout West Malaysia and is imported from Thailand and exported to Singapore. There are good bus and taxi services and long-distance buses link the main centres of West Malaysia.

The role and importance of the fishing industry

Agriculture provides employment for about half the labour force and produces roughly two thirds of the country's exports, mainly rubber and palm oil; timber and tin are the other principal exports. The manufacturing industries at present make a relatively small contribution to the economy, little more than 10 percent of the GDP.

The government is actively encouraging this sector of the economy and there are a number of new industrial complexes, mainly on the west coast of West Malaysia, which provide employment for increasing numbers of the work force; many of these are small-scale secondary industries which provide work for young girls rather than for the heads of households. Rice production meets some 90 percent of the country's needs for this staple and the country is a net exporter of both fish for human consumption and fish for animal feeding.

The fishing industry cannot be regarded as one of the more important sectors of the Malaysian economy if one considers only the monetary value of its products. But, fish provides roughly half of the animal protein in the Malaysian diet; it is eaten by people of all races and for some in the lower income groups it is almost the only source of animal protein available, for some fish is sold at very low prices. The annual *per caput* supply of fish, estimated at over 25 kg, is high by world standards. This is almost certainly an underestimate since it is almost impossible to estimate the contribution made by subsistence fishing.

In Malaysia as a whole some 68 000 fishermen are estimated to be employed in the primary sector of the industry (4); only a few thousand are employed on larger vessels which are considered to be outside the scope of this study so perhaps 60 000 would be a reasonable estimate of the number employed in the artisanal fisheries in the primary sector. If we assume that a 10:1 ratio exists between primary and secondary sectors then a further 6-7 000 people are employed in the secondary sector.

This is important to the nation for unemployment, thought to be currently somewhere close to 12 percent of the work force, is a serious problem, more so on the west coast of West Malaysia than on the east coast or in East Malaysia. Substantial quantities of fish products are exported; these are currently valued at around U.S.$ 40 million.

The present situation of the fisheries

Immediately following the second world war the industry was in a chaotic state, many fishing boats had been lost and there was a shortage of twine and netting for fishing gear manufacture. These shortages were quickly overcome and in the succeeding years fish landings increased in a steady but not spectacular fashion. Until 1950 only a small proportion of the fishing fleet was motorized, in the fifties the number of motorized vessels increased steadily. At first outboard engines were widely used in spite of the efforts of the Fisheries Department to discourage this development which, while bringing an increase in the landings, did little to increase the net income of the fishermen. The traditional fishing craft were sailing boats, mostly long, narrow and of shallow draft. They left on the land breeze before dawn and returned on the sea breeze in the late afternoon; when the wind failed they could be paddled easily. Fitting outboard motors offered few problems but the narrow hull designs ensured that the engines had a short life where the boats were used in a seaway as the engine was constantly strained by variations in propellor depth. The fishermen gradually came to realize that inboard diesel engines offered substantial advantages in economy of operation as well as in reliability. Few of the traditional boats could be fitted with inboard engines without extensive modifications and these have gradually been replaced with larger more beamy boats. The draft is still restricted by the shallowness of the rivers from which many work and the design of many, adapted from that which evolved for the coastal trading vessels, is far from ideal for fishing purposes (16).

The motorization programme has not proceeded evenly throughout Malaysia. Many of the unmotorized craft are used in subsistence fisheries or work close inshore where a motor would offer no advantage. In West Malaysia there is little to be gained by increasing the proportion of motor boats; in East Malaysia there are gains to be made by changing to inboard engines.

An important contribution to the increase in landings was also made by the introduction of cockle farming in the mangrove areas of the west coast of West Malaysia. This activity transformed the villages which were able to take it up, for profits were high and individual incomes increased considerably.

During the fifties there were few other changes in the traditional structure of the industry. An immense variety of fishing methods were in use, many of them ingenious and based on an intimate knowledge of fish habits, and at least 70 distinct types of fishing gear could be recognized. Hand-lining was important, especially on the east coast of West Malaysia but both midwater and bottom longlines were used; drifted and fixed gill- and tanglenets provided employment for thousands of fishermen; beach seines, purse seines and other deep-water seines, fish traps and pots, swinging and fixed bagnets and a host of fishing stakes (fish corrals) were in use. In 1963 trawling was introduced to the State of Kedah and this single development has revolutionized the industry, doubling the catch in less than ten years. The trawl has driven many of the traditional gears off the sea, some, because they were less efficient means of taking demersal fish, others, the fishing stakes and bagnets, because they occupied ground needed for the trawlers and because the debris of abandoned stakes damaged the new gear. The most important fishing gears on the west coast of West Malaysia are now the trawl and purse seine although driftnets and hook and line gears still provide some employment; on the east coast the massive liftnet is still important and trawling is still relatively undeveloped there.

The number of trawl licences issued has been limited to certain areas and times, and the size of boat permitted to enter the fishery controlled. There were also restrictions on gear size. All these regulations have been modified from time to time and trawling has been developed in a controlled and rational manner.

The pattern of fish utilization has also changed over the years; immediately post-war, when there was a shortage of ice and the transport system was undeveloped, much of the catch was salted and sun-dried. The situation is now very different, only about one fifth of the catch is cured or converted into fermented products, most of the remainder is iced and sold fresh; there is little freezing other than the freezing of prawns (shrimps) for export and little canning. Any opportunity to exploit a new resource is eagerly seized, thus, when it was discovered that a market existed for processed jellyfish, this was immediately exploited and the industry earned some U.S.$ 4 million in one year. While there appears to be no general shortage of ice many fishermen complained that it is expensive. This is a long-standing grievance which should be overcome in the near future as more ice plants owned by the fishermen's associations are built. It is extremely difficult to offer even approximately accurate estimates of the cash income of Malaysian fishermen. Firth (2) made a study in some depth of the fishing industry of the Perupok area of Kelantan in 1939/40 and spent a further three months there in 1947 and six weeks in 1963. While his figures have little relevance to present-day conditions many of his observations are still valid and should be studied by anyone who contemplates a similar survey. Share systems are complex and vary from village to village; indeed more than one system may be used in the same village for similar gear; with some gears such as purse seines and liftnets a day's catch may vary from nothing to tens of tons. The only way to get accurate figures is to make an extended and detailed study as Firth did and the study covered only one small area; the cost of a nationwide survey, the results of which would be out of date in a few years, would be prohibitive. The need for further up-to-date studies is recognized and it is possible that a post for an economist who would study the social implications of changes in the industry will be established in the fisheries division. Since further changes in the structure of the industry are contemplated, this appointment would be a very valuable one.

Such figures as are available suggest that the average cash income of a Malaysian fisherman is of the order of M.$ 70 (U.S.$ 26) a month. A Penang trawl skipper is said to average M.$ 300 (U.S.$ 110) a month and a Penang trawl fisherman M.$ 200 (U.S.$ 74) a month.

Prospects for the development of the fishing industry

There are some possibilities for rationalizing the fishing in inshore waters by the introduction of trawling for prawns and reducing the number of fishermen who are attempting to earn a living in heavily fished areas. There are possibilities for developing the culture of fish and prawns in some of the brackish water areas but this development cannot be expected to have any great impact in the immediate future. There is little interest among Malaysian fishermen in attempting to exploit the oceanic stocks of tuna in the Indian Ocean. Malaysian Marine Industries, a joint venture with a Japanese company, claims to have trained 336 fishermen in the past 13 years (16) but only 22 have been employed after training; the trainees have apparently decided that they did not want to repeat the experience of spending several weeks at sea working an 18-h day. It is certainly not only that the work is hard: Malaysian fishermen are used to that, it is the long absences from home that are disliked. No record of the wages paid could be obtained.

The prospects for developing the trawl fisheries are much brighter; there are substantial known stocks on the continental shelf of the Indian Ocean which are at present little exploited and further substantial stocks are known to exist off the east coast of West Malaysia which are not exploited at all, as yet, from Malaysia. The first of the trawlers to exploit the east coast resources are already being built. There is thought to be some potential for also exploiting the pelagic stocks of the smaller tunas in the South China Sea by purse seining.

It is not expected that vessels capable of keeping the sea for more than a week at a time will be needed for any of the fisheries.

Government policy on fishery development

Malaysia has an excellent record for the implementation of her development plans. In 1965 the Malayan Second Five-Year Development Plan ended and the First Malaysia Development Plan covering the period 1966/70 was devised (17). This set out as the main socio-economic problems a heavy dependence on two export products, rubber and tin, a high rate of population increase, an uneven income distribution and a relatively low level of technical education. The main objectives of the plan were to promote integration of the states and peoples of Malaysia to provide steady increases in income and levels of consumption, to increase the well-being of the rural and low income groups, to generate employment opportunities, initiate new kinds of economic activity, educate and train the people, institute an effective programme of family planning, open new land for development, improve power supplies and transportation and health and welfare projects. The total planned outlay (public and private sectors combined) was M.$ 10 500 million (U.S.$ 3 900 million) of which M.$ 22.3 million (U.S.$ 8.3 million) was allocated for fisheries development.

The fisheries programme aimed at expanding research, training fishermen, assisting them to avail themselves of improved equipment, gear and other facilities, helping producers to improve processing and marketing methods and establishing the necessary infrastructure facilities for large scale and efficient marine fishing. The plans included the establishment of the Fishermen's Training Institute in Penang, with FAO/UNDP assistance, a new fisheries training centre at Labuan in Sabah and the Fisheries Training Centre at Bukit Tinggi in Penang. It was also proposed that fisheries mobile units should be set up to act as extension facilities and that fishermen's associations should be set up and assisted.

The rate of economic progress under the First Malaysia Plan was remarkable, GNP rose by an average of 6 percent per annum (the target rate of 4.9 percent). These results were achieved in the face of a decline in the price paid for almost all export products; volume of production was higher than had been thought possible. Fisheries output rose by an average of 8.2 percent per year during the plan period principally as a result of the introduction of trawling. Trawl units increased from 20 in 1965 to 734 in 1969 but increased motorization and improvements in the manufacture and design of other fishing gears also played a part. Fish export values rose from M.$ 41.7 million (U.S.$ 15.4 million) in 1963 to M.$ 95.2 million (U.S.$ 35 million) in 1970. Although M.$ 22.3 million (U.S.$ 8.3 million) had been allotted for fisheries development the estimated actual expenditure was only M.$ 9 million (U.S.$ 3.3 million). An important reason for this appears to have been the lack of trained manpower at graduate level or rather, the very rapid turnover of staff at this level which in effect produced the same result.

The Second Malaysia Development Plan (18) cites national unity as the overriding objective for the nation. To this end the plan requires the raising of income levels and an increase in employment opportunities and an acceleration of the pace of restructuring Malaysian society to correct the economic imbalance, the intention being to reduce and eventually eliminate the identification of race with economic function. This will involve the modernization of rural communities, growth in urban activities and the creation of a Malay commercial and industrial community. It is recognized that some of these objectives may require a generation or more for their full realization. An increase in employment opportunities is seen as one of the prime needs - to increase agricultural employment by 1.7 percent annually - an average of 25 000 jobs per year in West Malaysia requiring the development of new land at a rate of 150 000 ac a year. Much of this development will take place in the states of Penang and Johore; the plan target requires the resettlement of 23 700 families during 1971/75.

As more efficient capital-intensive fishing methods are introduced it is expected that there will be a need for fewer fishermen and it is anticipated that the number of fishermen will eventually be reduced to some 48 000-50 000. Most of those who leave the industry would be from rural areas and accustomed to working the land as well as the sea and it is anticipated that they will be among those joining the resettlement schemes. Some may perhaps take up aquaculture.

Some of the projects started during the First Malaysia Plan will come to fruition during the second, for instance, the harbours planned for Penang and Lumut are now being built. According to the Second Malaysia Plan the programme of the division of fisheries is designed to develop and exploit more fully Malaysia's fisheries resources and to improve the income of the fishermen.

An important feature of the programme will be the setting up of a Fisheries Industry Development Authority. This authority will be established to promote the more extensive use of modern techniques and provide cold storage and processing facilities. The authority will initially operate on the east coast of West Malaysia with a trawler fleet expected to number 300 by 1975. The activities of the authority will facilitate the transfer of low productivity inshore (artisanal) fishermen to the modern sector of the industry. New projects to develop fish landing facilities at Kuantan and Kuala Trengganu will be undertaken. These projects will include provision of warehouses, boatyards and cold storage and ice-making facilities. Training programmes for marine and inshore fishermen will be expanded. The Fishermen's Training Institute in Penang, which provides training in navigation, seamanship, gear maintenance and modern fishing techniques, will become fully operational. Extension services intended for the improvement of the artisanal fisheries will be expanded through the establishment and operations of fishermen's associations. The programme will also include research. A demersal fish resource survey will be undertaken to locate and determine the extent of offshore fish resources.

In March 1973 the Fisheries Industry Development Authority was not yet fully operational although the first of the trawlers for the east coast fishery were being built. It is likely that Kuantan may be developed as a commercial port in which case the question of its suitability as a fishing port will have to be reconsidered. It now seems unlikely that attempts will be made to develop Kuala Trengganu as a fishing port for use during the northeast monsoon although a marketing complex is already under construction there at a cost of M.$ 1.5 million (U.S.$ 555 000 million). This is 3 mi from the river mouth and 2 mi from the local retail market. A site at Chenering to the south of Kuala Trengganu appears to offer better prospects for development as a base for use during the northeast monsoon; present estimates are that this would cost some M.$ 6 million (U.S.$ 2.2 million).

The provision of facilities which make it possible for fishing to continue during the northeast monsoon will have a profound effect on the development of the fishing industry of the east coast. The Fishermen's Training Institute in Penang (FTI) is already fully operational and some fishermen's associations have been set up.

The implementation of the plans for fisheries development will require close cooperation between a number of different organizations within the Ministry of Agriculture and Fisheries. These include the Fisheries Division, the Food Technology Division, the Fisheries Industry Development Authority, the Malaysian Agricultural and Research Development Authority (MARDI) and the Federal Agricultural Marketing Authority (FAMA).

The Malaysian Fisheries Division has employed only Malaysian nationals since 1960; there are now 49 posts at the fisheries officer level and above (mainly graduates) and about 200 posts at more junior levels, excluding industrial staff. The division is headed by the Director-General whose headquarters are in Kuala Lumpur; his deputy, the Assistant Director-General (in charge of planning and development) and the officers in charge of fishermen's associations, extension work and ad hoc training and general administration, are also in headquarters as are a number of specialists. The Director of Research and Project Co-Manager of the FTI are stationed in Penang.

There is a relatively well developed extension service for freshwater fish culture. Most of the freshwater assistants have received training in culture techniques overseas as well as in Malaysia, they visit the farmers regularly and the advice they give is competent. None have been given specific training in extension techniques. No equivalent service is available to the fishermen. Some advice is available through the state fisheries offices or headquarters but few of the officers or assistants are fully trained. A headquarters

officer does some extension work, mainly by showing films to the fishermen and arranging discussions with them. This is of limited usefulness since few films directly relating to artisanal fisheries activities are available.

A more formal attempt to provide a marine extension service is now to be made through the fishermen's associations and they will need very strong support from all branches of the Fisheries Division and elsewhere.

Each state is in the charge of a Director of Fisheries (fisheries officer level) except that Kedah and Perlis are combined under one Director; a senior and experienced fisheries assistant (special grade) is stationed in each state office. The number of marine and freshwater fisheries assistants stationed in each state depends on the relative importance of marine and freshwater activities within the state, thus, there are 10 marine and 10 freshwater assistants in the state of Perak, 8 marine and 4 freshwater assistants in Johore and only 2 marine and 4 freshwater assistants in the smaller state of Malacca. The state organization of the Fisheries Division varies from state to state but the activities in the state of Trengganu may be take as an example. Here the Director of Fisheries supervises the Fisheries Training School and two fishermen's associations and manages a set of cold rooms as well as being responsible for fisheries administration, licensing and enforcement. A special grade fisheries assistant supervises the state office, inland fisheries work, licensing of trawlers and an assistant who is responsible for enforcement. There are 4 marine district fisheries offices each supervised by a fisheries assistant who is responsible for the collection of statistics, liaison with the fishermen and the licensing of fishing boats and fishing gears other than trawls. Thus, no specialists are employed in the state office; if advice on a particular technical point is needed it is sought from divisional headquarters.

In the time available it was not possible to review in any detail the staffing of the other organizations which have a part to play in fisheries development. The Food Technology Division is responsible for research and handling, storage utilization and processing and for the technical aspects of marketing fish. It is intended that the fish processing station at Kuala Trengganu should produce canned fish, frozen fish, fishmeal, fish crisps and other sea foods. In March 1973 the main activity lay in training personnel in the canning of small tunas using a pilot scale cannery. The present hand-line fisheries for tunas would not supply enough fish for a commercial cannery and the intention is to investigate the possibility of taking fish with purse seines. Fish is normally landed in excellent condition in Malaysia as it is mostly iced at sea and fishing trips are short. Ice is not used on the market slabs and even in the larger supermarkets in Kuala Lumpur one can see the more expensive varieties spoiling as they dry under a stream of cooled air. Ice should be freely used in both situations if optimum quality is to be achieved. There seems to be little need to freeze fish except for export; where fish, especially prawns, are frozen for export there is a need for better supervision of the factories and their quality control procedures.

The Fisheries Industry Development Authority established in 1972 is charged with the task of modernizing the fishing industry. In the immediate future it will be fairly fully occupied with the plans for developing a trawl fishery on the east coast. Its functions seem at present to lie in coordinating the activities of others, for crew training will apparently be a responsibility of the Fisheries Division and the building of the first boats is being supervised by the Fisheries Division and the Mara dockyard.

Marine fisheries research is the responsibility of the Director of Research of the Fisheries Division. The Malaysian Agricultural Research and Development Institute (MARDI), which was established in 1968, has taken over the Freshwater Fish Culture Research Institute at Batu Berendam in Malacca and will, in future, be responsible for research into fish culture in fresh and brackish waters.

The Federal Agricultural Marketing Authority (FAMA) put up a proposal for a fish marketing scheme in July 1970, the scheme was gazetted in April 1971 and a Fish Marketing Board was established in November 1971. The board consists of: a chairman, a representative of FAMA, a representative of the Fisheries Division, a representative of the Treasury, a representative of the Ministry of Agriculture and Fisheries

and 3-5 unofficial members who have wide knowledge or experience of the fish industry relating to marketing commerce or finance. The main objectives of the marketing scheme are to provide equitable returns to the fishermen, to improve marketing facilities in order to reduce marketing costs, to improve the quality of fish marketed, to ensure stable prices for fish to fishermen and to expand the market outlets for fish. The board has powers to regulate and control the wholesaling of fish, to prescribe the methods and procedures of sales, methods of weighing, handling and packaging fish, and grades and standards. It can issue licences to trade and itself engage in trade. It is intended that all wholesale sales shall be through markets operated on similar lines to those which have been so effective in Singapore and Hong Kong, i.e., by open auction. The situation is, however, rather different in Malaysia where fisheries landing points are scattered along the coastline; when the new fishing ports come into use this difficulty will be reduced but not entirely overcome. The scheme is already operating at some places, at Kampong Genting in Kelantan, for instance, a small landing jetty has been constructed and up to 5 t of prawns a day are landed by small local trawlers, sorted and weighed in front of the crew and held for auction. Settlement of the boat's account is made the following day and this has made the scheme attractive to the fishermen.

The Fish Marketing Board is thus taking over one of the functions of the fish dealer ("towkay" or "tauke") who has traditionally been responsible for fish marketing in Malaysia, his other function has been to act as a source of credit for the artisanal fishermen.

This is not the place to discuss in detail the provision of rural credit, a topic recently reviewed by Lawson (19). The system operated in Malaysia was a very fluid one not always wholly to the disadvantage of the fishermen but, any such system hampers the development of a modern industry. One alternative is the cooperative society. Fishermen's cooperatives have had very limited success in Malaysia, they have proved successful only where there were already strong ties binding a group of fishermen together, or where such ties have been created, as with the issue of trawl licences. During the First Malaysia Plan, 61 farmers' associations were established in West Malaysia, these being multi-purpose associations covering an area of 5-6 000 ac and intended to provide extension, credit, processing, warehousing, transport and marketing facilities for the 1-2 000 families in the area. These were copied from the Taiwan model and success with these led to the decision to create the fishermen's associations (Persatuan Nelayan) to provide extension services to the fishermen, particularly, of course, the artisanal fishermen. It is intended that these should be guided by government officers until such time as the fishermen are able to take over the management themselves. This, it is hoped, will overcome the prime reason for the failure of the former cooperative societies which the associations will resemble in many respects, lack of adequate leadership. The intention is that any group of 50 or more fishermen shall be eligible to form an area or district association and that these may be confederated to the state and national levels. Membership will be open to anyone over the age of 18 who fishes for a minimum of 90 days a year, who processes or trades in fish or who gets 60 percent or more of his income from working in the fishing industry. Members may join only one area association and will pay an entrance fee and annual subscription and must buy at least one share which will cost M.$ 5 (U.S.$ 1.85). The Government is providing up to M.$ 20 000 (U.S.$ 7 407) for the erection or purchase of buildings or equipment and M.$ 10 000 (U.S.$ 3 703) to form a revolving fund for each area association. There will be no limit to the number of shares a man may hold but voting will be on a one-man, one-vote basis. The Director of Fisheries in each state will be responsible for the registration and supervision of the associations within his state; it is intended that he should be assisted by an officer and two assistants but it appeared that these posts were not established at the time of my visit. Some Fisheries Division officers were already working full time on association matters but it will be necessary to recruit and train others.

Training facilities at present available

Courses for fisheries helmsmen and engine drivers for the artisanal sector were started in Penang in 1953 so Malaysia has a rather longer history of fisheries training than most other countries in southeast Asia. There are now two small schools which provide upgrading

training for artisanal fishermen and the Fishermen's Training Institute (FTI) all of which were visited. It was not possible to visit the Inland Fisheries Training Centre at Bukit Tinggi in Pahang or the station at Kuala Kangsar in Perak.

The Fishermen's Training Institute, Batu Maung, Penang was equipped with funds provided under FAO/UNDP project MAL 68-520 to train skippers and engineers for the larger fishing vessels. Total cost was M.$ 3.1 million (U.S.$ 1.15 million) of which the Malaysian Government contributed M.$ 1.8 million (U.S.$ 0.67 million). The site is on the foreshore and covers an area of 17 ac, extensive filling was necessary to prepare the site for building and this delayed completion of the buildings the last of which was being occupied in March 1973. The buildings include dormitories, kitchen, dining hall and recreation rooms for the trainees, staff quarters, an administrative block, classrooms, net loft and engineering workshop. All are constructed to very high standards; a great deal of careful thought obviously went into the layout of the site and planning of the buildings. As a result, Malaysia has one of the best fisheries training facilities in the world. The same careful thought went into the detailed design of the navigation room, net loft and engineering facilities. The institute owns three training vessels, the largest of which is a trawler purse seiner 97 ft overall and 200 t. This is a much bigger vessel than any at present engaged in the commercial fisheries (except for the tuna longliners). Built as FAO-59 this vessel was named K L KURAU; she has a main engine of 495 hp, refrigerated fishhold of 90 t capacity, a combination purse seine/trawl winch and also a power block. Accommodation is for 16 students and range is 25 days. K L BAWAL, built locally, is 66 ft overall and 72 t and has a 2-drum trawl winch, carriers 11 students and has a cruising range of 10 days. A 36-ft wooden motor launch, the K L BILIS is used for local transport and for practice in pilotage. The two large vessels are well fitted with electronic fishfinding and navigating gear.

Student accommodation is available for a maximum of 120 but student numbers are kept below this level because it would be quite impossible to give adequate sea-going experience if more trainees were accepted at one time. A total of 2 760 applications was received for the first courses (one-year courses for skippers or enginemen) and from these a total of 51 was selected, 41 from West Malaysia and 10 from East Malaysia. The intake was given two months general orientation training and was then divided into two groups, 30 taking the skippers course and 21 the engineers. All teaching is in English. Training ashore included navigation and seamanship and fishing gear and methods for the skippers and marine engineering for the engineers. At sea the skipper trainees fished shrimp and fish trawls and purse seines and learned to handle and navigate the vessels and to use the electronic equipment. The intention is to produce men capable of becoming masters of fishing vessels up to 100 ft operating in a limited area possibly set at 60 mi from shore, and engineers for vessels of a similar size. The Merchant Shipping Ordinance does not, at present, require certification of fishing skippers or engineers. By the time the first group had completed their courses no agreement had been reached as to the manning requirements for fishing vessels so an ad hoc examination was set by the Director of Marine and Surveyor of Ships for the skippers and engineers. The institute set a formal examination in fishing techniques and the St. John's Ambulance Brigade examined in first aid. Three of those who had completed the skipper's course failed an eyesight test, 14 of the remaining 25 satisfied the examiners; 8 of the 21 who appeared for the engineering examination qualified. On this occasion the failed candidates are being given an additional 3 months tuition after which time most are expected to pass. Trainees are now given an eyesight test before commencing the course; results to date indicate that 10-12 percent of Malaysian fishermen are colour blind.

The origin of the marine fisheries schools lies in the need felt in the fifties for training artisanal fishermen in the care and maintenance of engines as the motorization programme got under way. At that time it was intended that the Merchant Shipping Ordinance should require the certification of helmsmen and enginemen for even the smallest inboard engined fishing boats. Courses lasting 3 months were then given and some hundreds of young artisanal fishermen passed through the Penang school. In November 1960 the present buildings in Penang were opened and the Kuala Trengganu school opened in May 1961; to date nearly 2 000 men have passed through these schools. Students are accepted between the ages of 20 and 30; minimum requirements are primary school education and 3 years sea-going experience. All instruction is in Malay and tuition is free; an allowance of M.$ 85 (U.S.$ 31.50) is paid monthly; a small charge is made for food.

The fishermen's school at Glugor, Penang offers a 10-month course starting in January each year and ending in November, 30 trainees being accepted for each course. Two places are reserved for students from each of the east coast states. The buildings are well constructed and fitted out and a good range of materials is available for demonstration though some might now be updated. The staff are long experienced and have produced sets of notes in Malay on navigation, engine repair and fishing gears and methods. A fishing gear demonstration tank has been built for use with model gears. The library is adequate and the staff have access to the research library close at hand. Ashore, 3 h in the morning are spent in the classroom, the remainder of the day being spent in practical instruction. The TALANG, a 55-ft 54-t twin screw vessel is used for training, the staff remarked that her 100 hp engine lacked towing power. She carries 10 students at a time and the usual arrangement is for a group to spend a fortnight at sea alternating this with periods of training ashore. At the conclusion of the course students sit for the third-class engine drivers certificate or the helmsman certificate and also for Fisheries Division examinations. No records have been kept of the employment found by past students but the staff thought that some 70 percent of them were working in the fishing industry mainly in the artisanal sector. Some ex-students have been employed by the Fisheries Division and others are known to be working on coastal traders; in both cases the training has had useful results if not precisely those intended.

The Marine Fisheries School at Saberang Takir, Kuala Trengganu, accepts students of similar qualifications but runs two 5-month courses every year, also, taking in 30 trainees at a time. The existing buildings are adequate for their purpose but the equipment is not quite so good as that available in Penang; the school has no boat of its own. The course here is pitched at a rather low level since many of the trainees have had only a minimum of formal education, the staff are not trained teachers but nonetheless the students reach the standard needed for certification. My impression was that the courses are extremely practical and have met the past needs of the artisanal fisheries of the area very well. Local opinion was that most trainees return to the industry after completing the course since little other opportunity for employment exists. Some ex-students have found jobs ashore looking after factory engines, servicing buses, etc. In 1972 the Director of Fisheries, Trengganu, used the facilities of the school to run four 2-week courses on safety at sea and two 1-week courses on engine maintenance for local fishermen; these were apparently well received.

Some use has been made of the SEAFDEC school at Lam Fapah near Bangkok. One ex-student, who is a serving government officer, indicated that the 1-year course he attended was really meant for sea-going personnel; it was intended to produce offshore fishermen, skilled in the use of the trawl and tuna longline. He had spent 6 months at sea in 4 trips of 1½ months each and had visited Singapore, Malaysia, The Philippines and South Vietnam during his training. The course had obviously only been moderately useful to him, the most useful part being the training in fishing gear manufacture and use.

A number of officers of the Fisheries Division have received training overseas, 3 have obtained high degrees in biological subjects and 3 in engineering, an electronics specialist was trained in Italy and a naval architect in the U.K.; 5 officers have received training at St. John College, Newfoundland. Two fisheries officers obtained their first degree in Tokyo; 3 have attended the fisheries officers course at Grimsby in the U.K.; 6 fisheries assistants have attended the course at Misaki in Japan. Many other officers have attended short courses or made short study visits. Many trained officers have been lost through resignation to take up employment in the more remunerative private sector in the past 10 years. The position appears to be more stable now but at one stage there were 22 resignations in 2 years (16). The more recently recruited fisheries assistants have received no training at all in some cases; all would benefit from additional training.

Future training needs

There is a need to improve the technical knowledge of many of the fisheries officers and fisheries assistants, especially those who will assist with the formation of the new fishermen's associations and thus operate the new extension service for artisanal fishermen,

and of the officers who will run the new fish marketing complexes. The crews for the new trawlers for the east coast will require training while all existing facilities for training fishermen and fish culturists should obviously continue. It had not been possible to recruit all the counterpart staff needed at the FTI at the time it was visited so there is still a need to train counterpart to replace the international staff. There will be a continuing need to train recruits to both the Fisheries Division and to the industry. Obviously there must be a very flexible approach to fisheries education and training if the best use is to be made of existing facilities.

It is suggested that the role of the FTI should be re-defined and that it should also be used for more diverse training than at present. The FTI has excellent facilities and these should be used for the training of government officers and artisanal fishermen as well as distant water fishermen. A change of title to Fisheries Training Institute would make the new role clear. The present project should be extended to permit the training of the as yet unrecruited counterparts for the masterfishermen and to start the new courses detailed elswhere. It is known that it is proving difficult to find suitable counterparts for some posts; the problem seems to be at least partly that the salaries offered do not attract adequately qualified people who have secure careers elsewhere. The possibility of revising the salary scale should therefore be considered.

The two schools should continue their primary function of training artisanal fishermen but should be used for ad hoc courses whenever possible.

The plans to extend trawling from east coast ports imply a need for at least an additional 100 trawler skippers and 100 enginemen in the next few years. Some experienced skippers from the artisanal sectors who are used to operating other gears wish to change over to trawling and this will have to be the main source of expertise for the immediate future; for the graduates from the Fishermen's Training Institute are too young and inexperienced to take sole charge of the new trawlers.

The experienced skippers are already capable fishermen and seamen; they lack experience in handling vessels the size of the new trawlers and of fishing, rigging and repairing trawls. None have any experience of using winches. It was reported that a small number of east coast artisanal fishermen have been sent to the west coast to acquire trawling experience but that this did not produce entirely satisfactory results. It would be better if training could be given from or nearer to the home ports and preferably on the new boats.

First priority should be given to the training of crews for the east coast even if this requires some temporary disruption of the present programmes for the FTI and schools. Since this is upgrading training, only a limited amount of formal tuition is required. The crews for these boats should be trained as units, either in the boat which they will take over or an exactly similar one. Little attempt should be made to teach any theory as these are skilled artisanal fishermen who need (in the immediate future) only to be taught the practicalities of the business of trawling. This would be a familiarization course. A training centre should be set up based on the Fisheries School, Trengganu. This would require that the courses for young fishermen should be temporarily discontinued since the residential accommodation would be needed. It should be possible to train four crews at a time.

The training staff should consist of the present instructors supervised by a skilled trawl fisherman, with a skilled assistant capable of taking a trawler to sea with minimal supervision. The trawl fisherman could be one of the masterfishermen from the FTI or an international expert might be recruited for one year. Recruitment of an international expert would take time even if funds can be found, while the temporary loss of one of the masterfishermen would disrupt the FTI programme. The coxswain (serang) in charge of the research vessel PENYELIDEK I could also do the job, but this would disrupt the research programme. The training of the trawler crews should be regarded as more important than rigid adherence to the FTI training programme and the use of one of the FTI masterfishermen should be preferred. This course would require approval from several quarters. If it cannot be agreed, the alternative of using the coxswain of the PENYELIDEK I should be accepted.

A graduate from the FTI should be able to act as assistant instructor; it should be possible to train either this man, or a fisherman, to take over in about a year, possibly in as little as six months.

The familiarization course should last for one month. The entire crew would spend one week learning trawl-net construction and repair; the existing staff of the fisheries school should be able to cope with this given a minimum of supervision. A second week should be devoted to safety at sea, particular attention being paid to winch operation. Again, the existing staff should be able to give this course. Two weeks would then be spent fishing under the guidance of the trawling instructor or his assistant who should alternate between the two crews under training. If two crews enter training every fortnight the school could provide accommodation for all and it would be possible to train about 40 crews in a year. Assuming that each crew would have a member used to operating engines slightly smaller than those in the new trawlers, depending on the ability of the individual needing training, the engineman could join the rest of the crew during the first two weeks or spend this at sea with the course ahead. The school staff should be able to cover this aspect of the training. One engineman and one skipper graduate from the FTI would be useful assistant instructors for the courses.

The need to improve the technical knowledge of the fisheries officers can best be met by courses overseas if only because these provide an opportunity to examine modern fishing industries and their equipment. This is sure to be a slow process since only one or two officers can be spared from their duties at a time. Much could also be done by using the facilities of the FTI to provide technical courses to increase the effectiveness of the officers doing extension work. It is important that this should be considered early as otherwise the opportunity to use the services of the remaining international staff will be lost. The officers who are to run the new fish marketing complexes should be given introductory courses so that they can learn something of the background to Malaysian fisheries. The facilities of the FTI, or one of the fisheries schools, could be used for this although most of the lecturers might have to be drawn from the staff of the Fisheries Division rather than from the regular staff. A two-week course followed by a study tour of the Malaysian ports and markets, which would in turn be followed by a two-week observation tour of the Hong Kong fish market, would provide a very useful background.

In the chapter on Thailand it is suggested (page 28) that the facilities of SEAFDEC should be used to provide courses of instruction which could be suitable for fisheries assistants from the contributing countries. Such a course would solve the problem of providing the technical training needed by Malaysian fisheries assistants. If such a course does not eventuate, the facilities of the FTI should be used to give a series of short ad hoc courses. This should be done in any case for the assistants who cannot be sent on a full course of training.

All those at present engaged in extension work would benefit from a course of training in extension methods. Since it is the intention of government that the number of fishermen should be reduced to around 50 000, there is no need for any increase in staff numbers for extension purposes. There will, of course, be a need for re-training the personnel who will leave the industry but that is hardly a matter for the Fisheries Department.

The officers who are assisting with the formation of the new fishermen's associations are experienced fisheries workers but they would benefit from short courses of instruction in the methods to be employed in the new associations. The speed at which the members of the new associations can be trained to take over full responsibility for the running of the associations could be increased if the leaders are given short courses of training; these might be arranged at the FTI or at one or both of the fishermen's schools.

There appears still to be a lack of skilled engine repairers in some of the fishing villages. Engine repair is one of the fields in which few Malays have specialized in the past and one which they should be encouraged to enter in the future. Few of the engine repairers in Malaysian workshops have any technical qualifications, almost all have learned their trade on-the-job. This would not be a satisfactory method for new entrants for whom

one or more courses at the FTI should be arranged. The best source of trainees might be men who have spent some years at sea in the artisanal fisheries following one of the earlier courses at the Penang Fishermen's School for these men would have both theoretical and practical experience. A six-month course should enable such men to qualify as repairmen; longer courses would be needed for trainees who have less experience. Such trainees would not have the capital to start a small workshop; they would need some form of government loan or subsidy.

The number of certificated, but inexperienced, graduates from the FTI is at present small. Little thought appears to have been given to the way in which these people will be employed. They can obviously only take charge of fishing vessels of any size after they have gained experience which they could acquire as crew members of the new east coast trawlers where their technical expertise would support the sea-going experience of the senior members of the crews. Ultimately, of course, they should be able to take charge of such vessels or their engines.

All of the men in charge of fisheries training establishments remarked that there is, at present, little real incentive for fishermen to come forward for training because there are no mandatory requirements for certification of fishermen. This must come eventually if the standards of the industry are to rise and the sooner satisfactory arrangements can be made the better. There will, of course, have to be a rather long period of grace before the requirements become absolute in order to enable men who are at present skippering vessels or looking after the engines to prepare themselves and obtain certificates. Upgrading courses for existing fishermen could well be given at the FTI as a regular routine. This will be the eventual role of the FTI once expansion of the industry stops and all that will be needed will be upgrading training.

Summary

1. The Fisheries Division has expanded rapidly in recent years and, in spite of the losses of trained staff which have occurred, most objectives of the Development Plans are being attained. The fishing industry, in particular the artisanal sector, has also advanced rapidly through motorization of fishing vessels and the use of modern fishing gears. Many improvements in living conditions in the rural areas have been achieved.

2. The extension service for fish culturists appears to be reasonably effective; some of the new recruits to the service need further technical training and all officers would benefit from a course of instruction in extension methods.

3. The marine fisheries extension service, which is to operate through the fishermen's associations, will succeed only if the staff are given technical training as well as courses in extension methods. Since it is through this service that government expects to reach the 60 000 or so fishermen who form the artisanal sector, this training should have high priority.

4. The two fisheries schools have served a very useful purpose in giving upgrading training to artisanal fishermen. The schools are likely to be needed for this purpose for some years to come. The Trengganu school could also be used for short ad hoc courses whenever opportunity can be made.

5. In the past, fisheries assistants for the marine service have been trained on-the-job and have attended whatever courses could be found for them. These men are the backbone of the Fisheries Division and it is important that their training be put on a more regular and formal basis. One problem is that the number required by Malaysia is small as is the case in many other countries in the region. It would thus seem that a regional training centre for fisheries assistants would be the best and cheapest way to provide training. It is suggested that the facilities at the SEAFDEC in Thailand could be used for this.

6. The Fishermen's Training Institute should perhaps be renamed the Fisheries Training Institute. Employment opportunities must be devised for the students who are taking skippers' and engineers' courses at the institute; these courses should be also to acquire practical experience which is essential for taking full responsibility. The criteria for the selection of students might be reconsidered and the training curricula changed to include experienced small-boat artisanal fishermen. The FTI should, in any case, be used also to give short technical courses to fisheries officers, fisheries assistants, the officers who will run the fish marketing complexes and engine repairmen. If statutory requirements for the certification of small-boat fishermen are introduced the facilities may also be needed for upgrading training for artisanal fishermen.

THAILAND

The Gulf of Thailand is little affected by monsoon conditions and fishing is possible the year round. The South China coast suffers somewhat less from the effects of the north-easterly monsoon than does the southern coast of the Kra peninsula. The Indian Ocean is exposed to the southwesterly monsoon but this rarely prevents fishing for more than a few days in each year.

The role and importance of the fishing industry

Agriculture provides employment for a substantial proportion of the work force the major crops being rice, rubber, maize, kenaf and cassava. Exports of tin and iron ore make significant contributions to export earnings.

Thailand is a net exporter of fisheries products and the *per caput* supply of nearly 25 kg a year is high by world standards. This represents a major part of the supplies of animal protein available in the country and the fact that over 70 percent of the total recorded landings was used for non-food purposes is evidence that the food needs of the population are well met by the industry. In many other countries in southeast Asia much of the fish at present regarded as trash in Thailand and used for duck or fish food, or reduced to fishmeal, would be used for human food. The fishing industry also plays an important role by providing employment.

The First Census of Marine Fisheries in Thailand (6) gives the number of men engaged in marine fishing as 78 394, a more recent estimate (7) puts the total at 75 000 plus "a considerable number of part-time and subsistence fishermen". There is a difficulty here as the Census is based on the enumeration of three types of fisheries households: the enterprise household, defined as a fisheries household which always employs more than three permanently sea-going employees; the fisheries employees households which are those where the family members are employed as fisheries labourers; and the subsistence households defined as households without employees or less than three employees. Households with exactly three employees seem to have been lost in translation. Presumably the term "subsistence fishermen" is used in FAO Country Profile for Thailand (7) in the usual sense of fishermen who fish only for food for their own family. No source gives any clear indication as to the number of fishermen in the artisanal fisheries. However, the Marine Fishery Inventory Survey (8) gives the total number of fishing boats in 1970 as 27 521 of which some 2 400 are otter trawlers, 265 pair-trawling units and 429 purse seiners. This suggests that a total of some 24 000 smaller craft are included in the total number of fishing boats. While these vary in size the average crew would consist of two men so that some 48 000 fishermen would be included in the artisanal fisheries together with an estimated 2 000 men who are engaged solely in collecting shellfish or in other marine activities. No figures are available for the numbers engaged in the freshwater fisheries including culture operations, but since a total annual production of 100 000 metric tons of freshwater fish is quoted (7) the number to be included in the artisanal fisheries must be substantial although much of the fish referred to must be taken in the subsistence fisheries using this term in its usual sense.

The present situation of the fisheries

Table 3 shows the estimated annual catches in Thailand from 1959 to 1971 for a number of groups of species; these figures, like many others quoted, should be taken as only broadly indicative of the changes that have taken place since the methods for the collection and compilation of fisheries statistics are under constant review and improvement.

In general terms, the situation in Thailand is similar to that in Malaysia but the published statistics suggest a very much higher productivity per man-year. This is, in part, due to the explosive development of the trawl fisheries and in part due to the fact that shellfish collection is more important in Thailand than in Malaysia. However, Tiews (10) suggests that the official statistics for the trawl fisheries for 1970 give rather high figures basing his arguments on the records of the official trawling surveys made in 1963 and from 1966 to 1971. The Preliminary Report on Marine Fisheries Production in 1971 (11) gives the production by household fisheries (a term which includes those fisheries operated by family members and thus roughly equivalent to and certainly including the artisanal fisheries) as 35 percent of the estimated landing of 1 470 289 metric tons, which is 514 601 metric tons. It seems likely that a substantial proportion of this fish was landed by the subsistence fisheries using this term in the usual sense. No figures estimating the number of men engaged in the subsistence or household fisheries are available. If we estimate that the number of fishermen in the artisanal fishery is even approximately correct at 50 000 and if we accept, with some reservation, that the average catch by a fisherman in this group could be as high as four tons we arrive at a figure of 200 000 tons for the landing by the artisanal fisheries. Whatever the truth may be it is certain that the artisanal fisheries take an important proportion of the annual fish landings in Thailand.

Tiews 1973 (10) gives a very detailed summary of recent history of the Thai fishing industry in his paper on Fishery Development and Management in Thailand delivered at the FAO Technical Conference on Fishery Management and Development held in Vancouver, Canada. In his paper Tiews traces the development of the trawl fishery from the time of its introduction by the German team which he led until the present time.

Attempts to introduce trawl fishing to this area had been made previously; none had succeeded. The earliest of these attempts was made in 1926 and the latest in 1955-56. These were experiments using gear similar to that used in the European fisheries; little effort seems to have been made to modify the gear to suit local conditions or to market the smaller fishes which form such a prominent part of the catch of the trawls. In many cases, the main reason for the failure of some of these earlier attempts probably lies in the fact that the mesh size used, especially in the cod end, permitted the escape of many marketable fishes. The gear was also of course constructed of cotton and hemp and very heavy indeed when compared with the nets now in use. One might say that the reason for the failure of the earlier attempts was that they were made too early.

The German team from the Fisheries Research Station, Hamburg devised and demonstrated a two-seam otter trawl in 1961, this became known as the Thai trawl or Engel trawl after its designer. Demonstration of this and other nets continued through 1962-64 during which time an assessment of the trawl fish resources of Thailand was made. From 1966-71 the team helped the Fisheries Department to establish the Marine Fisheries Research Laboratory in Bangkok and provided advice on management aspects. The research service now employs more than 60 scientists, 11 of whom have received training in the Hamburg laboratory and many others elsewhere.

No attempt seems to have been made by government to control the licensing of trawlers; by 1971 there were a total of 2 684 boats engaged in the fishery (Table 2, page 4). The concept of an exhaustible sea is quite new to southeast Asia and there were, no doubt, considerable pressures demanding freedom to participate in the new fishery. With the landings of demersal fish rising from 44 900 metric tons in 1960 to 919 000 metric tons in 1970 (Table 3, page 21) it is easy to see why there was a reluctance to impose restrictions.

Table 3

Estimated annual fish catches for Thailand 1959/71
('000 metric tons)

Group of species	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Marine													
Mackerels	36.1	29.9	23.2	36.0	23.3	52.5	69.9	87.8	30.9	148.1	131.9	139.6	149.0
Sharks and rays	2.8	4.3	4.0	4.5	5.1	5.8	7.4	6.8	8.0	12.3	18.8	26.0	9.5
Other demersal fish	42.1	44.9	102.6	126.8	190.0	327.2	338.9	384.4	442.2	602.3	773.4	919.2	1 003.5
Shrimps and crabs	13.5	14.5	16.5	20.2	32.5	38.7	46.3	57.3	75.1	99.2	91.2	132.2	127.1
Molluscs	53.2	52.8	87.0	82.2	72.4	40.0	66.9	98.8	105.7	141.8	164.4	266.5	181.0
Total	147.7	146.4	233.3	269.7	323.3	494.1	529.4	635.1	761.9	1 003.7	1 179.7	1 483.5	1 470.2
Freshwater													
Air breathers	20.6	35.0	22.7	25.2	49.0	26.5	35.7	38.7	39.7	41.0	40.6	45.4	48.9
Carps	7.3	7.5	9.0	9.6	8.0	7.7	9.7	9.9	8.9	7.8	6.0	12.2	10.0
Miscellaneous	26.0	25.7	37.4	31.8	35.0	44.8	36.3	33.2	33.0	32.8	37.8	51.0	54.9
Prawns	3.1	4.4	3.3	3.5	3.4	3.8	4.0	3.3	3.7	4.0	4.1	4.3	2.9
Total	57.0	72.6	72.4	70.1	95.4	82.8	85.7	85.1	85.5	85.1	89.9	111.6	116.7
Total catch	204.7	219.0	305.7	339.8	418.7	576.9	615.1	720.2	847.4	1 088.8	1 269.6	1 595.1	1 587.0

Source: Tiews 1973. Fisheries Record of Thailand for 1971 (10)
These are not in agreement, order of magnitude probably correct

This unrestricted development has, however, resulted in a severe reduction in catch per unit effort. It is of interest to note that, while the official records show that the trawl fish landings rose from zero to 658 922 metric tons between 1960 and 1971, landings by other gears apparently increased from 146 400 metric tons to 587 278 metric tons (Table 3 and reference (11)). This is almost exactly a fourfold increase. The reasons for this increase are not so well documented as the reasons for the development of the trawl fishery but both the gillnet fisheries and the purse seine fisheries have been developing in parallel with the trawling industry and much of the artisanal sector has been modernized in the urban areas. The introduction of the longtail boat (boats fitted with very long-shafted outboard engines swivelled at the balance point), increasing motorization of other vessels and the use of synthetic materials for gear manufacture have all played a part. The statistics are not truly comparable as the methodology for collection and compilation has changed.

In many cases the artisanal fishermen of the gulf and east coast are fishing in areas which are already heavily exploited. Modernization of the industry in these areas is unlikely to result in an increase in landings and a rationalization of the industry with a reduction in the number of people directly dependent on the artisanal fisheries is to be desired. Some of the fishermen in the artisanal sector are using modern equipment. The development of the artisanal fisheries has, however, been very uneven. Those artisanal fishermen who live close to the larger towns have either joined in the development of the trawl and purse seine fisheries or have been able to acquire modern equipment with which to work in the inshore areas. In the more rural areas of the east coast and gulf areas the industry is still undeveloped and the living conditions of the fishermen and their families leave much to be desired. The consultant was unable to visit the west coast in the time available to him, but from the discussions he was able to hold it would appear that in the rural areas of the west coast the artisanal fisheries are, if anything, less well developed than those of the east coast.

Government receives a considerable revenue from the fisheries, according to Tiews (10) this amounted to Baht 153 million (U.S.$ 7.6 million) in 1967 and much of this money has been used to improve landing and marketing facilities, to provide loans and to provide research and extension services.

The pattern of fish utilization has changed with the modernization of the industry; in 1960 the Bangkok Fish Market handled 37 318 metric tons of fresh marine fish and 2 045 metric tons of salted fish; in 1965 the fresh marine fish handling was 57 216 metric tons but only 935 tons of salted fish passed through the market (20). Some drying activities are still of importance, much of the squid catch is dried (21) and the boiling and drying of shrimp is still practised. Formerly, considerable quantities of Rastrelliger and other fish were boiled in salted water prior to sale; this activity continues but on a much reduced scale. Fermented pastes and sauces are still made but the quantity of fish used in their preparation has not kept pace with the general increase in fish landings. The bulk of the catch is now iced at sea and sold fresh; there is some freezing of shrimp and squid for export but little other freezing is practised; there is no fish canning of note.

Here, as elsewhere in southeast Asia, it is difficult to arrive at any accurate figure for fishermen's incomes. A series of social and economic studies of the various fisheries would be of great use in planning future development; so far as is known none have been made.

While the freshwater fisheries have not seen the same spectacular increase in production as the marine fisheries there has been some progress in spite of the loss of the formerly important flood fisheries in the north due to dam construction. While great efforts have been made in recent years to improve the quality of the marine fisheries statistics, less attention seems to have been directed to the collection of facts about the freshwater fisheries; these are undoubtedly important in the economy but it will be impossible to plan the development on sensible lines unless the collection of statistics is improved.

Prospects for the development of the fishing industry

The fish resources of the Gulf of Thailand are probably already being harvested fully; any expansion of the trawl fishery would therefore have to take place in the South China Sea or in the Indian Ocean. No doubt both sources will yield some demersal fish in the coming years but it is important to remember that other countries are also planning to increase their fishing efforts in the South China Sea.

Since they are closer to the fishing grounds it will be easier for them to fish these grounds profitably. It is to be expected that there will be a rationalization of the trawler fleet in Thailand with the less efficient units being withdrawn from the fishery; certainly expert opinion seems to be that there are too many boats chasing too few fish. It is difficult to provide for the regulation of a tropical trawl fishery; these fisheries depend on over 200 species of fish even the taxonomy of some of which is in doubt. Almost nothing is known about the breeding habits, growth rates or natural mortality of any of these. Direct age determination is impossible as growth is even throughout the year so that no annual rings are laid down as in cold water fish; tagging experiments have so far yielded little in the way of useful results. In any case the task of attempting to sort out the relative importance of the multitude of species involved almost defies imagination. Many of these fishes mature at a very small size; this has led to the use of very small cod end meshes; the industry is heavily dependent on the landing of trash fish for its profitability. Any attempts to define the likely effects of the continuance of the trawl fishery at its present level are speculative; there have already been some changes in the catch composition as well as a decline in the catch per unit effort. Some decline in the catch per unit effort was, of course, to be expected. Since it is almost impossible to plan the future of the fishery by biological investigations, this must be based on economic considerations; the fishery may well become self-regulating. This would require that some of the fishermen who have earned a living from trawling during recent years will have to seek other employment. Some will, no doubt, re-join the artisanal sector, others will have to seek work ashore.

The prospects for increasing the catches of pelagic species are thought to be rather better. Regulation of the Rastrelliger fishery by the imposition of a closed season during the period of breeding has apparently been effective. Although it has been said that the Rastrelliger fishery has reached its maximum potential (7) in fact, catches have continued to rise in recent years.

Since there are thought to be some prospects for further development of the trawl fishery on the west coast it may be expected that some artisanal fishermen will move into this sector. There will, however, be a rather limited number of openings in this fishery and it is at least possible that some of these may be filled by migrant fishermen from the east coast trawl fishery. While this area is not so rich in marine resources as the Gulf of Thailand, modernization of the equipment used in the artisanal fisheries could be expected to produce increases in landings of the same order as those obtained elsewhere. A programme of improvement in communications would also be needed if the fish caught are to be moved to the east other than as salted or dried fish.

The artisanal fisheries conducted from the urban areas of the east coast and gulf areas appear to be capable of little further development. The grounds are already fished intensively and in these areas increase in production must rely on the introduction of culture techniques. In the rural areas there are some possibilities for increasing the landings from the artisanal fisheries by the improvement and modernization of the equipment used, but no really substantial increases are to be expected for the waters off these areas are also fished quite intensively. Improvements in the infrastructure of the industries would, of course, greatly improve the living conditions of the fishermen in these communities. In many cases fish is being salted and dried at great cost in labour and is then fetching substantially less money than it would have done could it have been sold fresh. Shrimp which could be frozen and exported are also being boiled and dried, so losing value.

Improved management techniques in inland waters may produce additional yields from the swamp and small lake fisheries; there are possibilities of increasing the area under freshwater fish culture especially in the north. There are also prospects of increasing the yield from coastal aquaculture; traditional methods of shrimp farming yield, on average, about 25 kg/ha/year from some 10 000 ha. It is hoped to raise this to a level of 100 kg/ha by feeding the shrimp; experiments in breeding one species have shown that it may be possible to produce stocks for culture rather than relying on the natural supply. There is already some culture of sea bass (Lates calcarifer) using wild fry and feeding trash fish and attempts to breed this species are being made. There is an area of some 2 000 km^2 of mud flat and mangrove swamp in which culture techniques might be practised.

Several of the fish culture techniques require the use of cheap trash fish as food (shrimp, Lates, Clarias cultures). If at some time in the future it becomes impossible to provide the trash at low prices the prospects for success in these culture techniques will diminish. It is more than likely that the cost of supplying trash fish will rise if uncontrolled development of the trawl fishery is permitted to continue as overfishing in every sense and a drop in catch per unit effort on all fishing grounds will result.

Many of the species taken in the trawl and here regarded as trash, mainly because of their small size, would be eaten elsewhere. Small quantities are dried and exported and the possibility of expanding this trade might be investigated. It is also possible that some of this fish could be exported in other forms. It may be possible to develop products which would be consumed locally.

Government policy on fishery development

The Third National Economic and Social Development Plan (1972/76) (22) has as its major objectives:

(i) to restructure the economic system and promote economic growth;

(ii) to maintain a reasonable level of foreign exchange reserves and price stability and to overcome immediate problems, particularly the decline in the overall economic growth rate;

(iii) to promote economic growth in the rural areas and to reduce the income disparities;

(iv) to promote social justice;

(v) to develop manpower resources and to create employment; and

(vi) to promote the role of the private sector in economic development.

During the period 1967 to 1971 the average annual growth rate of the fishery sector was 17.3 percent; it is recognized that this rate of growth cannot be maintained and a target of 10 percent has been set for the third plan. This is probably much too ambitious, the earlier growth rates were achieved under peculiar conditions which no longer apply; there is not much more to come from the trawl fishery in the way of growth. What little can be obtained from the trawl fishery will be got by fishing at a greater distance from the home ports on grounds more easily reached by other nations. Any increase from such sources is likely to be ephemeral as these other nations are also starting trawling industries.

It is planned that the artisanal capture fisheries should be developed through the establishment of fishermen's associations and that the extension service should operate through these associations. These plans are at present neither well defined nor well developed.

There are plans to increase the productivity of the present small-scale coastal aquaculture enterprises and to start others and to improve the inland fisheries culture enterprises. There are plans to increase the export of some marine products especially the high value shrimp.

The fishing industry is also seen as a source of revenue. Boats and gears are licensed and there are manning regulations for the fishing vessels.

The Fisheries Department has its central administration headed by the Director-General in Bangkok; the regional administrations cover provincial and district fisheries offices. The central administration is divided into a Secretariat Office which includes the General Services Section, Finance Section, Fisheries Statistics Section and the Information and Public Relations Section; a Division of Administration and Control, which includes the Fisheries Control Section, the Fisheries Revenue and Registration Section and Socio-economics Section; a Division of Marine Fisheries which includes exploratory fishing and fishing craft, a Fish Section, Marine Invertebrate Section, Food Technology Section and Marine Fisheries Station Section; a Division of Inland Fisheries which includes the Fish Culture Experiment Section, Fish Culture Extension Section, an Engineering Section and the Upland Fisheries Station Section (20). It is intended that the department should be reorganized into six divisions. The technical fisheries officers are in most cases graduates from the 3- or 5-year courses in the Fisheries College (the Faculty of Fisheries at Kasesart University), the administrative fisheries officers, who are in charge of provincial and district offices, are highschool graduates.

The provincial fisheries officers supervise and inspect the district offices, enforce fisheries laws and regulations, collect fisheries statistics, make surveys and carry out general administrative functions. Licences are issued by the district officers who collect revenue and act as enforcement officers.

Both provincial and district offices are expected to provide marine extension services in addition to carrying out the executive functions listed above. None of the fisheries officers have received technical training overseas, none have received any training in extension methods. The marine fisheries extension service thus exists in theory rather than in practice.

The officers responsible for the freshwater extension service have no administrative functions, the indications are that these officers would also benefit from further training.

A considerable proportion of the fish landed in Thailand is sold through the Bangkok Fish Market; this was established in 1953 by the Fish Marketing Organization which came into being in the same year. The organization is responsible for providing landing places and other marketing facilities; it charges a flat rate of 1 percent of the sales value on all transactions made in its markets, 25 percent of the collected charges are set aside as a rural welfare fund, the remainder being used for the operating expenses of the organization and for development programmes. Sonkla now has an excellent marketing facility, another is planned at Phuket in 1974.

Training facilities at present available

Training for some high-level sea-going personnel is available at the Petty Officers' School in Cholburi province and at the Naval Academy (23); fishermen have not been trained at these in the past and it seems unlikely that any use could be made of them in the future. Unfortunately, time did not permit my visiting either institution.

The Phra Nakorn Sri Ayuthaya Boatbuilding School operated by the Department of Vocational Education offers training in the construction of wooden boats. During a recent FAO Technical Assistance assignment a number of boatbuilders were taught to build in ferro-cement.

Although there are requirements for the certification of fishing boat skippers and engineers no school for training personnel in these categories exists. The examination and licensing of sea-going personnel are the responsibility of the Harbour Department. I understand that all examinations are conducted by senior officers of the department who are stationed in Bangkok, visiting other ports as required, and that the examination for second

grade (up to 20 tons) and for first grade (20-50 tons) is verbal only; for higher grades a written examination in chart work and navigation is held. The first two levels are presumably quite low; facilities for training to the higher level exist only for those fishermen who can speak English (at the SEAFDEC school). One short course of training was held for the fishermen some 15 years ago; it was not thought worthwhile repeating this because the fishermen manage to pass the Harbour Department's examinations without formal training.

Nearly 90 officers of the Fisheries Department have received training of one sort or another abroad, the majority have been trained in fisheries biology or some allied scientific discipline but a number of technologists have also been trained. Countries which have provided facilities for training include Australia, the Republic of China, Denmark, the Federal Republic of Germany, India, Japan, Norway, Singapore, the U.K., the U.S.A., and Yugoslavia.

The Southeast Asia Development Centre (SEAFDEC) was established as a result of a Thai initiative at the Conference on the Economic Development of the Southeast Asian Region held in Tokyo in 1966. There are now ten southeast Asian nations involved in the organization the aims of which are:

(i) to train fishermen and fisheries technicians from the member countries to spread the knowledge and skills of modern techniques;

(ii) to establish the fisheries most suited to a particular region;

(iii) to develop new fishing grounds and investigate available stocks and undertake localized oceanographic research;

(iv) to collect and analyse information related to fisheries in southeast Asia; and

(v) to provide members with the results of research and development undertaken by the centre (25).

There are, at present, two departments, the one at Lam Fapah which was intended to train fishing skippers for high seas fishing, and a research department at Changi in Singapore. The original intention was that the Lam Fapah centre should be used to train fishermen for high seas fishing; in particular, it was thought that it would be necessary to produce skippers and engineers for tuna longliners. Deep sea fishing has not developed so quickly as was expected and none of the first people trained are working in boats which fish far offshore. Facilities include well equipped classrooms, workshops and dormitories ashore and a trawler/tuna longliner.

The vessel is important as the trainees spend at least half of their course time at sea; the Paknam is 137 ft (41.8 m) overall, has a moulded beam of 28 ft (8.5 m) and draught of 12 ft (3.6 m), her main engine is a 1 000 hp six-cylinder diesel giving a service speed of 10.5 kn. The fishhold is refrigerated, fishing gear includes a hydraulic trawl winch, line hauler and net hauler, there is a full range of electronic fishfinding and navigating equipment. In the early years the centre was staffed almost entirely with Japanese instructors, nationals from some of the other countries participating in the venture have now been trained, partly on-the-job, partly in Japan. There is apparently no difficulty in finding instructors who are competent to teach navigation, seamanship and engineering but it is difficult to find fishing gear instructors outside Japan. The staff are, at present, paid on international wage scales; this should not be necessary in the future and reversion to locally acceptable scales would reduce running costs considerably.

The course at first devised lasted for one year, fifty students at a time took a course which emphasized fishing techniques (trawling and tuna longlining) but also included navigation and seamanship and some engineering. The students spent 6 months of the year at sea in 4 trips lasting 6 weeks each; during these trips the vessel usually called at ports in neighbouring countries. Requirements for admission to the course include the ability to read, write and speak English; students should be between 20 and 25 years old and have spent one year at sea. A trainee meeting these requirements who completed the course would have a fair degree of competence as a fisherman but would certainly not be able to take a deep

sea fishing boat to sea; none of the countries using the school would, in fact, issue a sea-going certificate to him until he had completed a substantially longer period of sea time. The courses which are now given provide for a greater degree of specialization in fishing, navigation or engineering, they last for 2 years and each sea trip lasts for 4 months. This is because middle-distance fishing has become more important than was originally expected while deep sea fishing has not yet developed; the countries using the centre are tending to use graduates as instructors rather than as fishermen. This has never been the intention of SEAFDEC, it still being thought that deep sea fishing will develop. The need for extension work is, however, recognized by SEAFDEC and it is planned that mobile units will be set up to move into any of the member countries and give assistance and practical demonstrations.

This would make it possible for some of the instructors to be more fully employed. At present, some of them are idle when the vessel is at sea; some of this time has been used to visit former trainees as a follow-up to the course to learn how to improve future courses.

This initiative has provided a regional facility which should be cheaper to run than a series of national facilities; the consultant's impression is that it is already doing a useful job and that the staff are doing all they can to learn from past experience and to improve the courses. There are some problems; the boat has not been bringing in much income, the longer trips should help with this; trainee selection has not been perfect; for Thailand at least future selection will be by competitive examination; the trainees do not spend any time working under commercial conditions. The present cost of training is believed to be of the order of U.S.$ 3 500 per student year.

As already noted, the marine extension service is not at present as effective as it should be. This is largely due to the lack of trained officers to man the service but some reorganization is also required. In the absence of an adequately trained extension service, there are no facilities for the training of marine artisanal fishermen. During the period 1964/67 the German team, which introduced trawling by using the demonstration methods which an extension service should employ, showed, very effectively, how useful such a service could be in Thailand.

Much the same seems to be true of the freshwater extension service. Although the officers manning this have been given better technical training than those in the marine service they would benefit from further training.

Future training needs

The Thai fishing industry still retains the optimism which results from the boom conditions of the last decade. There is a need to consolidate recent gains, however, to exploit the trawl fishery more efficiently and provide assistance and guidance to the artisanal fisheries. This will require the strengthening of the Fisheries Department, more particularly of its extension service, regardless of whether government decides to intervene and control the fishing activities of the trawlers or whether the laissez-faire policy continues. Tiews (10) explains that, with the present statistical service, it would be impossible to regulate the effort of the trawling industry by a catch quota system and that other methods such as increase of mesh size, closed season during spawning time or the closure of areas for the protection of spawning beds are impractical here because the fishery is dependent upon over 200 species of fish, some of which mature at a very small size and whose spawning habits are little understood. Limitation of effort, i.e., by issuing licences for a limited number of vessels of different sizes to fish the various grounds available would be the only practical solution. Such measures have not been imposed. The nearby grounds are already heavily fished; there is little doubt that the Thai trawlers are already fishing some grounds at a considerable distance from their home ports which could be fished more economically by fleets from the countries closer to these grounds.

These countries are now starting to develop their trawl fisheries. There appears to be no interest in developing a tuna longline fishery from Thailand. It would thus seem that there is little need to train more than a very small number of fishing skippers or engineers for large vessels. The prime need is to provide training for the operators in the artisanal fisheries.

Tiews also explains how trawl fishing was introduced by an extension system; clearly the simple methods used were very effective. Short training courses were held in the villages, the gear was demonstrated and construction plans for suitable nets were distributed. The Thai fishermen must have been good teachers as well as good pupils for it was they who introduced trawl fishing to West Malaysia. This is an indication that workers with sufficient, but by no means advanced technical knowledge, can be useful extension workers in some situations. Both the Thai and the Malay fishermen were experts in the traditional methods, the Thais had acquired a little new know-how.

Ideally the extension worker should not have any executive functions. This would be rather expensive and the most practical way to improve the marine extension service in Thailand would be to improve the technical ability of the provincial and district fishery officers so that they can give some advice themselves, but, more important, so that they will know when to call in expert advice and know where to find it. High-level expertise would be provided by the specialists employed in the research and experimental stations and also SEAFDEC. The only training needed at this level would be a short course in extension methods and the use of audio-visual aids.

A course of training to raise the technical ability of the provincial and district fishery officers to the level at which they would be able to advise adequately on any topic likely to come their way would last at least one year and preferably two. Courses of this length are impractical at present, the service is needed now and neither the personnel to teach the course nor the funds to run it would easily be found, nor could the in-service staff be spared from their duties for this length of time. A course lasting six months would provide a very useful technical background and it is suggested that all the district fishery officers should go through such a course as soon as possible (excluding any officers who are so old that they would not be able to give long enough service to justify the expense of training).

In discussion with the Secretary-General and Chief of the Training Department of SEAFDEC the consultant was given to understand that it is planned that, subject to the agreement of the council, SEAFDEC should itself provide an extension service and send teams into member countries. This is possible because some staff remain ashore when the centre's vessel is at sea. While this initiative would be an extremely valuable one, SEAFDEC could make a far greater impact by training extension workers rather than training fishermen. The extension workers become teachers and it is thus possible to spread knowledge rapidly. In cases where a team approach is desirable it would still be more effective for SEAFDEC to train a team from each country which needs the technique rather than to demonstrate it in each country. This would be so even if the teams took longer to train than would fishermen, in some cases, as has already been demonstrated by the Thai fishermen who took trawling to West Malaysia, it would be possible to train teams of fishermen and employ them as extension workers.

It is suggested, therefore, that the spare capacity of SEAFDEC, i.e., the non sea-going staff, should be employed in extension worker training. This would, of course, require the agreement of the members, some of whom may not want to train extension workers, but it would seem none of these countries has an effective marine extension service and that all need trained workers. If there is any considerable demand for places on such a course it would become necessary to provide additional accommodation and one or more additional training vessels at Lam Fapah; these would be combination vessels of about 50 ft overall designed for short trips only. It is possible that part of the course could, with advantage, be run by the Research Centre at Changi, Singapore. So far as the Thai Fisheries Service is concerned, it might also be necessary to recruit a number of new officers (equal to the number attending the course at any one time) so that all posts are filled while officers are trained. Teaching would have to be in English; this should be less of a problem in training junior officers from the member countries than fishermen.

Swingle and Shell (24) recommended that the Inland Fisheries Division of the central administration should be reorganized into three units. The first of these to be called the Training and Information Unit would be responsible for the preparation of audio-visual aids and aquaculture manuals, for preparing public exhibits for training extension workers and disseminating information. The second unit, Aquaculture Services, would have direct supervision of the field stations and extension personnel, briefing the field workers on new results from the research stations and planning demonstrations of new techniques. The third unit would be a statistical one which would plan surveys to determine numbers and areas of ponds, reservoirs and swamps and their productivity and to compile annual fish production data and other data needed to plan fisheries development in inland waters and to evaluate the effectiveness of extension activities. The same writers noted a division of responsibility between the Extension Section in Bangkok and the officers in charge of the Inland Fisheries Stations and suggested that the extension workers needed better training and that the extension manuals in use could be improved by the use of simpler language, better illustrations and should include the results of recent research.

There is also a need to strengthen the freshwater extension service by improving the training of the extension workers. A regional approach to this problem, similar to the SEAFDEC one, would have much to commend it as it would make best use of available funds and expertise. It is understood that SEAFDEC would like to introduce a freshwater centre at some time in the future, if so, this would certainly be worthy of international support. In the meantime, Thailand will have to meet the problem of training freshwater extension workers from its own resources.

The best immediate solution would seem to be to convert an existing research or experimental station to a training institute. Research workers would give the training preferably after they have themselves received a course of training in instruction techniques. The training institute would require the provision of dormitory, laboratory and classroom accommodation, cooking and dining facilities, and the provision of some equipment. None need be elaborate or expensive and if the accommodation is carefully planned it should be possible to use it for housing junior staff at the station if at some time in the future training facilities are no longer needed. Since the consultant did not visit the Freshwater Research Station, no suggestion as to which should be converted can be made here. Since the freshwater extension workers have no administrative or executive functions, there should be no need to employ a training reserve.

There is also a need to improve the technical knowledge of the more senior fisheries officers. It is suggested that graduates who are in general service where a technical background (rather than a research background) would be valuable should attend the one-year course in fisheries management at Grimsby, England, or the two-year fisheries officers' course at Bombay, India. Non-graduates, particularly the younger men at the provincial fishery officers level, would benefit more from the course in Coastal Fisheries at Misaki International Training Centre, Japan.

A large number of research workers have been trained in recent years, obviously many of these people should be considered to be an integral part of the extension service. It would be useful if those who will frequently be involved in extension work could be given a course in extension methods and the use of audio-visual aids.

There appears to be little need at present for formal training for fishermen beyond what is already being done by SEAFDEC. Less formal training should be arranged by the extension service through the fishermen's associations when these are established.

There are already many competent boatbuilders who build by eye. The quickest way to improve the design of local fishing vessels would be to import plans and teach the younger boatbuilders to read and use these. The possibility of offering a course of part-time study at technical colleges should be investigated.

A small number of fishing gear technicians will be needed at some time in the future; at present, fishermen apparently make up their own trawls and purse seines. One would expect that, in the future, such nets will be made in factories as this should be both cheaper and more efficient. SEAFDEC has the facilities to train fishing gear technicians; graduates from the fishing skippers' course should be able to fill these positions if they are not needed at sea.

Summary

1. Thailand has seen an explosive development of her fisheries based principally on the introduction of bottom trawling. Fish consumption within the country is high and there are important export trades.

2. Government policy on fisheries development at present concentrates rather heavily on the trawl and purse seine fisheries and fish culture. The important marine capture artisanal fisheries would repay the more concentrated effort which should be put into their development.

3. The Thai Fisheries Department appears to have directed more attention to the training of research workers than to the training of technologists and fisheries managers. There is now an urgent need to improve the efficiency of the executive arm of the fisheries administration and to establish effective marine and freshwater extension services.

4. The staff and facilities of the SEAFDEC are being used to provide training for high-seas or distant-water fisheries which now seem unlikely to develop to the extent originally envisaged in most of the member countries. It is suggested that some of the staff and facilities of the SEAFDEC should be used to provide training for marine extension workers.

5. While a regional initiative similar in concept to the SEAFDEC would also be the best way to provide training for freshwater extension workers, in the immediate future Thailand should develop its own training facilities for these personnel by converting an existing experimental station.

6. Senior, especially graduate, fisheries officers should be given the opportunity of attending courses of management training overseas.

7. All the officers who will be involved in extension work or in training extension workers should be given a course of training in extension methods and the use of audio-visual aids.

8. The possibility of offering part-time courses for boatbuilders at the technical colleges should be investigated.

FIJI

The role and importance of the fishing industry

The *per caput* supply of fish is estimated to be 15 kg/year, some four fifths of this is imported so the existing industry is of importance mainly because it supplies the fresh fish available to much of the population. Tuna landed at the freezing and cold storage base is not marketed locally in any quantity.

The present situation of the fisheries

There is, at present, almost no recognizable fishing industry; a small number of fishermen use flat-bottomed punts of from 5-8 m length for fishing small-meshed gillnets, handlines, etc. Few of the fishermen are working even at the artisanal level; many are subsistence fishermen. A variety of fish is taken with the few methods in use, including crustaceans and molluscs; there is a small pearl culture farm.

In an attempt to upgrade some of the fisheries and to provide a cash income, the Fisheries Division introduced a training programme in 1968 in which the fishermen were taken aboard the Fisheries Division vessels to work with the crew (26). Selected fishermen were thus taught the elements of boatbuilding, fishing and fish handling preservation and marketing. From this developed the concept of the small-unit fisheries in which small groups of fishermen have been encouraged to fish for the Suva market. The main justification for the original scheme was to make better use of the division's research and experimental vessels by linking the training programme to these. As the project has now been expanded, the intention is to provide the outer island with a means of earning a living. Ice silos and fish holding facilities have been put in at selected sites and the division's boats are used to provide a collection service; the catches are sold on a wholesale market and the resulting income used, in part, as savings to create capital. Once some capital has been accumulated the resources of the Fiji Development Bank may be used to acquire more modern equipment. There is also a self-help system under which the fishermen build new vessels under supervision and using facilities provided by government. Training is, at present, also being given in seamanship and boathandling and maintenance, engine operation and maintenance, fishing techniques and fishhandling.

There has been continual expansion of the project; when it started there were 6 schemes, in 1971 there were 20, the result is that the project now uses most of the division's resources. The division is unable to provide all the assistance that is needed and the facilities originally provided for experimental fishing are occupied full time by the project. Some schemes have been much more successful than others. During the last 3 years of full operations the number of schemes increased by two and a half times; the annual output of the schemes, as measured by the quantities collected by the division's vessels, increased by only 17 percent, i.e., from 64 545 kg in 1969 to 75 909 kg in 1971. Of the 196 818 kg of fish collected in this period, 56 percent came from 4 schemes, 41 percent from 2 schemes and 30 percent from one scheme. Since the inception of the project, the gross value to the schemes of the fish produced and marketed has been close to U.S.$ 50 000 of which about U.S.$ 23 000 has been returned to the schemes as cash and the remaining U.S.$ 27 000 held in trust as obligatory savings. Monthly cash incomes have generally fallen during the period from 1969 to 1971, the Fisheries Division had used a large proportion of its resources on these schemes and the project would be a disastrous failure if considered in purely commercial terms. In the years 1970 and 1971 the annually recurrent costs of the vessels used as carriers was over U.S.$ 90 000 while the revenue arising from the fees charged for carrying fish was only U.S.$ 14 500 leaving a deficit of some U.S.$ 76 000 (this ignores depreciation on the vessels and amortization of their capital costs). The next period should be one of consolidation rather than expansion. The facilities provided are being underutilized. Each scheme has an ice silo capable of holding about 1-2 tons of ice and ice boxes to hold about 1 ton of fish plus ice; the fish is collected at fortnightly intervals so that the fishermen generally fish alternative weeks. On average the storage facilities are being used at about 10 percent of their potential. Under the present system, the carrier service as a whole would become economical at a transported weight in excess of 363 000 kg a year. The maximum carrying capacity is some 436 000 kg a year so under the present vessel schedules 90 percent utilization would be needed to break even.

The project must, of course, be seen as providing some training, not as a commercial failure, but there is no doubt whatsoever that it has expanded much too quickly. This, presumably, was due to political pressures. Whatever the reason there is a need for consolidation before there is any further expansion. Although the project was conceived to provide training, in fact, because of the rapidity with which is expanded, it has been impossible for the officers of the Fisheries Division to provide all the training originally intended. A great deal of time and effort will have to be put into extension work if new methods are to be introduced widely; many fishermen prefer to continue to use traditional methods which they know will at least provide some income rather than go to the trouble of learning a new technique so that long-term demonstrations may, in some cases, be needed.

Prospects for the development of the industry

Since there is a large demand for fish at present, satisfied by the import of (mainly) canned fish from abroad, there appear to be very good reasons for trying to establish a sound local industry. The annual per caput consumption is low and could well be raised; the rising population and increase in tourism all point in the same direction.

The small-unit fisheries project has shown that given proper support from an extension service these units could substantially increase their landings using handlines, gillnets and, in some cases, bottom set longlines and traps.

A two-year feasibility study has shown that there are good prospects for establishing a pole and line fishery based on the skipjack and other small tunas. The study has shown that small tuna are available in some quantity relatively close to the main islands, that bait is readily available and that both can be caught. Unfortunately, the fish concerned are not popular on the local market but since there is already a tuna trans-shipment base and small cannery, selling the catch should not be too difficult. The fishery may eventually become big enough to support a larger cannery.

Some exploratory prawn trawling has been undertaken, the results of this were sufficiently encouraging to suggest that a more thorough survey should be made.

Experiment has also shown that it is possible to culture oysters successfully using imported spat. Present indications are that this could be an attractive commercial proposition, the hanging culture method using rafts could produce very substantial quantities of oysters. The hotels would take some of the product but there are also export possibilities.

There are some prospects for developing fish culture both in freshwater and in the sea. Villaluz (27) suggests that it may well be possible to culture milk fish, mullet and spade fish as well as the Tilapia which are already established. Trials with grass carp, silver and big head carp have succeeded and it is possible that these will be introduced into the Rewa Waimanu and Waidina rivers.

Government policy on fishery development

Government policy is directed toward providing employment especially in the outer islands where there is little opportunity other than in fishing. According to Fiji's Sixth Development Plan 1971/75 (28) the main objective during the 5-year period will be the development of an economic domestic industry to provide regular supplies for local requirements and possibly for export. With the establishment of this domestic industry effort and resources will also be directed toward improving the livelihood of the traditional fishermen.

Specific objectives to be pursued during the plan period are:

(i) to promote and consolidate the development of all small-unit fisheries in the outer islands;

(ii) to investigate the feasibility of commercial fishing;

(iii) to train traditional fishermen in the use of modern techniques and equipment;

(iv) to provide adequate and efficient machinery for law enforcement and regulatory activities; and

(v) to undertake research and surveys into other fishery projects.

Local demand for fisheries products is expected to rise from 6 500 tons a year to 7 300 tons; it is hoped to increase local production from 1 600 tons to 5 440 tons a year by 1975. The output of coastal and estuarine fisheries is expected to increase by 20 percent and that of the small-unit fisheries by 50 percent every year. The tuna project (livebait or pole and line fishing) was expected to come into production in 1973 and to be producing

1 300 tons a year by the end of the plan period. The intention is to improve the existing fisheries and to consolidate the small-unit fisheries by providing advice and loans and, at the same time, to continue to develop new fisheries such as mollusc farming, freshwater culture projects and the livebait fishery for small tunas. The need for training at various levels is clearly recognized.

The plans for improvement obviously depend very heavily on the small-unit fisheries. Apparently none have so far been able to operate at a level of commercial success. The sole justification for continuing with these appears to be that government must provide assistance if fisheries development is to continue in the rural areas more especially in the outer islands. There should be much better advance planning and certainly no new schemes should be started until the present 20 are on a sound basis; it would be wise to examine each scheme carefully and to set targets and subtargets for each. The main point is, of course, that productivity must be increased if the carrier service is to be justified; this will require that the extension service should operate much more effectively than at present. There is almost a total lack of properly trained extension workers, the schemes are really very like the fishermen's associations being established elsewhere where experience has shown that government must provide advice and assistance on a day to day basis if there is to be any hope of success. In Fiji this would require that a junior officer of the Fisheries Division be attached to almost every project. The training of junior staff is commencing in 1973.

The proof of success of the small fisheries units would be for the carrier service to become commercially profitable. The carrier service has occupied almost all the resources of the Fisheries Division in the last few years and has thus effectively prevented other equally desirable developments: it has been impossible for the division to continue fishing experiments with deep-water lines and other fishing methods which might significantly increase the income of the small-unit fisheries. So long as the division's resources are tied up in the carrier service it will not be able to carry out its more important functions. In particular, the boats being used for the carrier service, for which they were not designed, should be released for other work and replaced with specially designed carriers. The National Marketing Authority could perhaps run the carrier service as well as the proposed services ashore, thus releasing the skilled personnel of the Fisheries Division for training, research and development work.

The Fisheries Division of the Ministry of Agriculture Fisheries and Forests did not exist until 1963 and only became active in 1967 (29). In 1973 the division had an establishment of 63 headed by an Assistant Director (Fisheries) under whom were a Principal Fisheries Officer, a Senior Fisheries Officer and two Fisheries Officers. The Fisheries Officer posts are filled by locally recruited graduates; the more senior posts are all filled by expatriates.

Training facilities at present available

The only training facilities at present available in Fiji are those provided by the Fisheries Division. These are limited to the advice given on an *ad hoc* day to day basis by officers of the division.

One Fisheries Officer has received training in the U.K., another is to start a course of training overseas in 1973.

Most of the remaining staff have received only on-the-job training from the senior staff. In many cases, this has obviously been very effective; a number of skippers and other boat crew have been trained to a level which has enabled the carrier service for the small-unit fisheries to operate, boats have been built and engined and some research and experimentation carried out. The division is receiving very effective support from the South Pacific Islands Fisheries Development Agency (SPIFDA). This includes periodical visits by the agency's staff and surveys and reports by consultants employed to examine fisheries prospects in the South Pacific Islands. These include surveys of the bêche-de-mer, turtle and spiny lobster resources, the possibilities of fish and shellfish culture, of reef and lagoon productivity and a report on fishing boat development.

The key post of Fisheries Officer (Training) was not filled in March 1973.

Future training needs

In the immediate future the main priority must be to bring the Fisheries Division to a state of fully trained efficiency as quickly as possible. The division could then provide an effective extension service through which the existing artisanal fisheries could be brought to a higher level of proficiency and assistance given with the establishment of the other fisheries envisaged.

In 1972 Lindsey published his report on Fishery Training in the Area Served by the University of the South Pacific (29). In his report Lindsey examines past and future expansion and the Government Fishery Services and projects the fisheries training needs for the region. Having examined the training resources available Lindsey puts forward a proposal for coordinated fishery training. It would be pointless to reproduce sections of the Lindsey report here, suffice to say that he recommends that the facilities of the University of the South Pacific, the Fiji College of Agriculture, the Derrick Technical Institute and the Fijian Fisheries Division, all in Suva, should be used to provide diploma level, degree level and post-graduate and in-service training in fisheries for Fiji and other countries in the region. The regional approach is undoubtedly the best that could be devised and the proposals are worthy of full support. The use of the existing facilities makes possible substantial economies since the whole of the first year and parts of the second and third years of the diploma course can be common with the agricultural diploma courses.

As Lindsey notes, there is an urgent need to provide training for people who are already in service in the Fisheries Division. He recommends a system of module training and special seminars to meet this need. This seems to be the most immediate of all the fishery training requirements in Fiji. If the fisheries development programme is to succeed, a soundly based extension service must be established and the first requirement for this is that the officers to man the service be adequately trained. The first graduates will become available in 1975, they will be few in number and totally inexperienced. In-service training for those already employed must be provided as the first priority both so that the development programme can continue and so that those already in service do not find themselves entirely without prospects for promotion when graduates start to join the service.

Lindsey divides the subjects for diploma and module training into biological subjects, marine or technology subjects and economic and social subjects.

All three groups may be of equal importance for diploma students but it is recommended very strongly that the marine technology subjects should have the highest priority for in-service trainees followed by the economic and social subjects. The biological subjects are much less important at this level, with the exception that some in-service trainees could obviously benefit from a course on aquaculture.

Lindsey's suggestion that groups of the module courses should be taught so that serving officers can obtain certificate level qualifications is a sound one. This should be taken a step further and a method whereby serving officers can obtain diploma level qualification should be built into the training system. This might be done by giving serving officers who achieve a certificate a year's full pay leave to attend the diploma course and take those parts of the second or third year which they lack. At some time in the future it will be advisable to downgrade the diploma course to certificate level to offer a course lasting two years for this and a third, more specialized year, for the diploma level. This would be in line with African experience. As secondary education improves, so the need for the teaching of academic subjects in the first year will diminish and, as the fisheries develop, so there will be a need for officers with an increasingly high degree of specialized training.

During 1974 and 1975 efforts should be made to hold seminars on topics which would be of interest throughout the region. One topic should be Extension Methods and the Use of Audio-Visual Aids. Other subjects which would also be of interest in most parts of the region and

which would certainly be useful in Fiji include Fish Processing Technology, Properties and Uses of Modern Materials for Fishing Gear Construction and Design and Construction of Fishing Gears.

There is, at present, no need for a Fishermen's Training School in Fiji. The training of fishermen should be undertaken by the Fisheries Division and more particularly by the extension service. Training should take two forms: demonstration units should be formed to introduce new equipment and methods (this is basically the concept which was used at the start of the small-units project); and individual extension workers should act as advisers to help with the day to day affairs of the established units.

Summary

The fishing industry of Fiji is, at present, mainly at the artisanal or preartisanal subsistence level. The Fisheries Division has accomplished a great deal during its short history in training junior staff and fishermen, building and motorizing boats and in research. Reduction in the present high dependence on imports to meet the countries needs for fish and fish products would seem to require:

1. Training for Fisheries Division junior staff, best accomplished by the implementation of the Lindsey proposals followed by the establishment of an effective extension service. A Fisheries Officer (Training) must be recruited as soon as possible; training of senior staff overseas should continue.

2. Consolidation of the existing small-unit fisheries and their establishment on a commercial basis. The Fisheries Division should be released from its present involvement in the carrier service so that its limited technical resources can be used to full advantage. In particular this would make possible concentration of effort on the training aspects.

3. Continuation of investigation into the feasibility of commercial fishing, fish and mollusc culture, the training of junior staff to assist in these and eventually in their implementation.

The best prospect for the establishment of a commercial fishery in the near future obviously lies in the already proven tuna pole and line or livebait fishery. While this would have little direct impact on local market supplies it should create employment and earn foreign currency which would help pay for imports.

Training could be assisted during the next few years by holding a number of seminars on fisheries topics; for reasons of economy these should be on a regional basis.

THE PHILIPPINES

The Philippines consists of a group of over 7 000 islands and islets of varying sizes. The island of Luzon, on which stands the capital Manila, is some 105 687 km^2 in area and the second largest island, Mindanao, is some 95 000 km^2 in area. None of the other islands approach this size. The group covers a total area of about 297 000 km^2 and stretches from 6°N to 21°N and from 117°E to 127°E. In the time available it was possible to visit only a small number of places on the islands of Luzon and Panay, conditions in some of the other islands may be very different from those seen.

In 1970 the population was estimated to be 36 849 000, since it is reported to be increasing at a rate of over 3 percent a year, in 1973 it was presumably of the order of 39 million. There are a million new mouths to feed every year and in 15-20 years time half a million new jobs will be needed every year even if one assumes that only the men will seek employment.

The area of continental shelf to a depth of 200 m, which is available to the fishing industry of The Philippines, has been estimated to be 184 600 km^2. Relatively little fishing

takes place at present in water much deeper than 50 m, in some places on the west coasts these inshore waters are already very heavily fished. Much of the shelf area has not yet been surveyed but it is known that quite substantial pelagic resources are available but underfished. Expansion is expected to lie with the commercial fisheries, little more being expected from the municipal fisheries.

The role and importance of the fishing industry

In 1970 the Gross Domestic Production was U.S.$ 6 332 million and the Agricultural Gross Domestic Production was U.S.$ 2 286 million. Agriculture provides employment for a substantial proportion of the population; manufacturing industries are of increasing importance but are mainly light finishing operations.

The per caput annual supply of fish of 30.7 kg is high by world standards and forms a large proportion of the animal protein supply in The Philippines. Even if annual consumption per caput remained at its present level the increase in population will generate an additional demand for some 470 000 tons by 1980. Both increases in income levels and improvements in distribution facilities can be expected to raise the demand further and it is anticipated that by 1980 total demand will be of the order of 1 700 000 tons a year or some 585 000 tons above current levels (5).

Fishing is of very considerable importance in the national economy both as an employer of labour and as a source of food.

The present situation of the fisheries

Between 80 and 90 percent of the total fish production comes from the relatively shallow waters of the Sulu and Visayan seas and Manila Bay. Four groups of fishes dominate the catches: the chub mackerel, the sardines, the slip mouths and the roundscads; these form some 34 percent of the landings.

Demand for fish is strong and prices high by world standards. One authority quoted U.S.$ 200 per ton as an average ex-vessel price for sardines, this compares with around U.S.$ 60 a ton in the U.S.A. The great fish reduction industries have been built on anchovies and other small clupeoid fishes sold ex-vessel at around U.S.$ 20 a ton. There is thus no prospect at present for a fishmeal industry.

Post-war increases in fish production were no doubt due largely to the motorization of the fishing fleets and increasing use of synthetic materials for fishing gear construction. Some improvements in the design of traditional fishing gears, such as the bag nets, were also made. There have also been some improvements in culture techniques and increases in the area under fish culture. During recent years the rate of increase has slowed down to about 3 percent a year.

Although the fisheries are divded largely for administrative reasons there are obviously considerable technical differences between the three elements and they are considered separately here.

The municipal fisheries provide employment for about half a million fishermen and there are said to be over 150 000 boats in use, some accounts quote up to 200 000 boats. About a quarter of the boats were said to be motorized in 1970 (5) but the proportion is now higher than this. The typical vessel is of simple wooden construction, of shallow draft and narrow beam; many are fitted with an outrigger. These bancas, as they are called, are usually owned by individual fishermen, the municipal fisheries may be regarded as typical artisanal fisheries. Motorization follows the typical early American pattern of using a simple petrol engine with direct drive, this provides a cheap and effective method of motorizing existing boats. Replacements are often built along traditional lines, and outboard engines are rare in the marine fisheries.

These craft are used to fish gill, tangle and trammel nets, bag nets, lines, fish traps, corrals and very small trawls as well as for the collection of shellfish and seaweeds. Although productivity per man and per vessel is rather low the municipal fisheries produce rather more than half of the fish landed in The Philippines, around 700 000 tons a year.

None of the bancas seen carried ice to sea, this is not important in present conditions and indeed it would be difficult for the bancas to carry ice. Some fish is salted and dried, some is used to make fish sauce, rather small quantities are smoked.

In 1972 there were 2 164 licensed vessels in the commercial fisheries totalling nearly 80 000 tons (5). The average of 36 tons disguises the fact that the individual vessels range in size from just over 3 tons to 600 tons. More than 700 of these vessels fish from the Rizal/Manila areas where the average vessel is over 70 tons, in regions remote from the capital the average size is usually close to 10 tons. Thus, many of the smaller vessels of the commercial fisheries should also be considered to form part of the artisanal sector. There are some 1 500 vessel owners most of whom own only one vessel; there are 5 fleets comprising more than 20 vessels each and 65 of more than 5 vessels each.

The range of operations also varies from about 5–800 km from the home port but most fishing operations take place within or very close to The Philippines archipelago. Some vessels, supported by iced fish carriers, spend up to 30 days at sea at a time but for the most the average trip duration is much less, a day or so for the smaller vessels and 5–10 days for the larger ones. Most of the vessels at present in use are wooden but there is a tendency to build larger vessels of steel.

Trawling and purse seining are replacing the traditional fishing methods and together accounted for over 60 percent of the fish taken by the commercial sector in most recent years. Improved methods of purse seining using light attraction techniques were introduced with great success by the recently completed 7-year FAO/UNDP project.

Until recently The Philippines lacked a modern fishing port, this deficiency has now been remedied by the building of a fishing harbour and terminal at Navotas to serve the greater Manila area and, indeed, most of Luzon Island. This development was financed by the World Bank at a reported cost of about U.S.$ 7 million.

Most of the fish taken in the commercial fisheries is iced at sea and sold fresh, ice is not everywhere in adequate supply at present but plans for improving the supply during the next few years exist. Relatively small quantities are at present frozen and with fish prices at their present level there is little scope for canning. The greater Manila area is the main market for fish products and substantial quantities of iced fish are carried by sea ferry from other islands.

Fish culture

More than 100 000 tons of fish are produced annually by the 155 000 farmers who operate ponds covering some 150 000 ha. Most pond complexes are thus small and almost the whole of the industry lies within the artisanal sector. Almost the entire production is from the farming of the milkfish Chanos chanos known locally as "bangos"; the fish are raised in brackish-water ponds. Small quantities of oysters are produced by culture on bamboo stakes planted in riverine areas and there is now some culture of shrimps.

Chanos is a remarkably useful fish for farming, it is hardy and relatively disease-resistant, if held on a maintenance ration in crowded conditions in a nursery pond it apparently suffers little and grows away well when given less crowded conditions and adequate food. Growth is rapid when the fish are well fed and the fish reach marketable size in a few months. It is a valued food fish for which good prices are paid. Since the fish spawn only in the open sea, stocking rates in the ponds can be controlled and the fish given optimum conditions for growth.

In the traditional culture method the ponds, which are shallow and drainable, are fallowed and dried and then flooded to a shallow depth to produce a dense growth of a complex of plant and animal materials known locally as "lab lab". As the water depth is increased the "lab lab" often breaks loose from the bottom mud where it originally forms and rises to the surface. The ponds are flooded with nutrient-bearing brackish water and there is little tradition of fertilizing the water. Where the use of inorganic fertilizers has been introduced substantially higher yields per unit area have been claimed. The yield from some of the better managed ponds under the traditional system is 700 kg/ha/year with good management yields of up to 1 500 kg/ha/year having been achieved. In some cases better results still have been obtained by using ponds deeper than the traditional ones and using inorganic fertilizers to produce a growth of planktonic rather than benthic organisms. Arguments about the relative merits of the "lab lab" and plankton methods rage whenever the protagonists meet, it seems that either method can produce good results given good management. The extension service, stiffened by the advent of a number of American peace corps volunteers is encouraging farmers in the use of the new techniques and also improving pond construction.

There is some farming of freshwater fish such as the introduced Tilapia but this is on a very small scale at present.

Prospects for the development of the fishing industry

Recent estimates suggest that the Philippine catch might be increased to some 1.6-1.8 million tons a year as compared with the present catch of about 0.9 million tons.

Under the Four Year Plan of the Philippines Fisheries Commission it is intended that about 150 new or improved vessels should enter the commercial fisheries in each of the next four years. In 1972/73, for instance, it is planned that 116 boats should be improved and 44 new ones commissioned (30). Each new or improved boat would add roughly 200 tons to the total landings (31) so the total increment in ten years would be 300 000 tons a year. The target for 1972/73 for this sector is 32 000 tons increase.

It is difficult to forecast the future of the municipal fisheries, many of the boats are using modern fishing gear and are already efficient for their size and area of operation. Others can no doubt be brought up to the same standards (motorization has increased the catch per vessel in some fisheries from 1-3 tons a year). The Four Year Plan calls for annual increase in landings of about 14 000 tons a year.

One barrier to the plans to increase production from fish culture may be the problem of obtaining sufficient fry. Present fry catching methods are crude and inefficient, more efficient methods such as trawling by push net are used successfully elsewhere. At present the fry grounds are leased by the municipalities in sectors of some 20 km every year. The concessionaires seldom fish themselves and the fry pass through several hands before reaching the pond operators. As a result, the pond owners often pay U.S.$ 1 for 50 fry for which the fishermen received U.S.$ 0.25. Termination of the leasing system of this publicly owned resource would benefit the municipal fishermen and the pond keepers as well as the public at large, for cheaper fry should mean cheaper table fish.

Several groups are attemping the difficult task of breeding Chanos the objectives being both to reduce the dependence on wild spawning and also to produce fry at prices lower than those paid at present.

There are also some 186 000 ha of land which might be used for freshwater fish culture. Experiments with Chinese carp have shown that here, as elsewhere, a properly managed mixture of common, grass, silver and big head carp can give yields exceeding 3 000 kg/ha/year. All are acceptable table fish in The Philippines. There is also interest in culturing Clarias which is a predatory air-breathing catfish; culture of this fish in Thailand is based on a plentiful supply of cheap trash fish as food. Such supplies are not available in The Philippines but very limited trials have shown that it may be possible to use a complete diet in pellet form, the commercial viability of the method is, so far, unproven.

Raft culture, using either local or imported oysters, would appear to be another possible development. Since oysters are in good demand locally this very productive method must offer distinct possibilities for the future.

Shrimp culture is not yet established on any scale; this, too, should prove profitable within a few years.

Government policy on fishery development

The Philippine Fishery Commission (PFC) is responsible for the operation of a four-year programme of fishery development which started in 1971 and terminates in 1974. [There are some inconsistencies in the production figures given in the plan (30) and elsewhere (5). The plan figures have been accepted for this section.]

The plan suggests that the six main reasons for the inability of the fishing industry to meet existing requirements for fishery products are:

(i) low productivity and declining yield of areas presently exploited and under-exploitation of many areas of the fishery resources;

(ii) lack of adequately trained manpower;

(iii) lack of capital and credit facilities;

(iv) poor marketing and distribution;

(v) need for improvement of processing techniques; and

(vi) lack of infrastructure, such as ports, ice plants, cold storage, etc.

The plan aims to promote import substitution and to reach self-sufficiency by the end of 1974. The major strategies involved are: increasing the yield per unit area in the culture fisheries; and the output per vessel in the capture fisheries; and increasing the area devoted to culture and the numbers of vessels engaged in the commercial fisheries. The target for fish production requires an annual increase in landings of 5.8 percent. In fiscal year 1973 this requires an increment of 88 300 tons of fish, the specific target allocations are:

	%	tons
Freshwater fisheries	20	17 700
Brackish-water fisheries	28	24 700
Municipal fisheries	15	13 200
Commercial fisheries	37	32 700
Total		88 300

According to Kvaran (31) the major targets to be hit by the end of 1974 are:

		Annual production in tons
Commercial fishery - new vessels	172	86 000
- improved vessels	430	46 000
Municipal fishery - new "bancas"	2 640	27 000
- improved "bancas"	8 600	27 000
Fishponds - brackish new area	19 530 ha	17 000
- brackish improved	53 200 ha	77 500
- freshwater new area	15 200 ha	11 000
- freshwater improved	21 800 ha	32 200
Communal waters area stocked	1 720 000 ha	26 300
Total increase in production		350 000

The fishpond programme requires the development of fry producing centres, the leasing of additional areas for fish ponds, the improvement of the extension service and continuation of the research programme.

The Commercial Fisheries Development Programme will rely on the fishing vessels of the PFC for demonstration and extension assistance to fishing boat operatives and potential investors. Surveys of possible new fishing grounds will continue.

The Navotas fish landing and market is complete, the harbour under construction; other ports are planned at Lucena and Bacolod. Vessel licensing and documentation are to be improved.

The municipal fisheries plan will require improvements in the fishery extension service, arrangements for credit assistance to fishermen who are cooperative society members through the small fisherman's credit fund and the organization of additional cooperative socities. These latter will improve the supply of equipment and organize marketing.

There are also plans to carry out research and development to improve the utilization of fish especially the carps, Chanos, roundscads, squids and shrimps. The PFC plans to establish and operate a number of pilot demonstration processing plants. It is also intended that a number of canneries should be established to reduce the dependence on imported supplies, the high prices presently paid for fish are likely to make it impossible to operate these economically. New ice and cold storage plants are also planned, the intention being that government should build and at first operate these later disposing of them to private interests. The plan notes a need for quality control and inspection and for product development.

So far as fishery regulation and general administration are concerned the main effort will be directed to the elimination of all forms of illegal fishing.

The manpower requirements noted for The Philippines Fishery Commission for the year 1973 are set out in Table 4.

Kvaran (31) gives estimates for the manpower requirements for the next ten years as:

	Total	Average per year
Commercial fishing		
Deck officers	3 000	300
Engine room officers	1 500	150
Extension workers		
Municipal fishery	600	60
Fish culture	540	54

The calculation for sea-going officers makes no allowance for wastage of any kind. The estimates are based on the assumption that one engineer and two deck officers will be needed for each of 1 500 vessels. The estimates for marine extension workers are based on the provision of one extension worker for every 10 fishing "barrios" of which there are 6 000. A different basis for calculation would be to assume that if there are 500 000 fishermen there are probably about 300 000 families, 1 extension worker for every 500 families would again suggest that 600 are needed, on a basis of 1 extension worker per 1 000 fishermen the number needed would be only 500. The last method is, however, better used where all villages are of easy access and under Philippines conditions the first or second method would undoubtedly give a better estimate. It is, of course, necessary to make a survey on the ground and decide exactly where each worker will be based and what area he will cover. This does not take into account the fact that there should also be about 1 supervising extension worker to every 5 extension workers; one could add a total of 120 for this grade.

Table 4

Personnel requirements for PFC, 1973 (Fiscal Year)

Programme	Total required	Existing			Additional required
		Fisheries technical	Non-fisheries technical	Non-technical	
(i) Improvement and development of fishponds and communal inland waters	905	565[a]	6	216	118
(ii) Improvement of municipal and/or sustenance fishing	281	168[b]	0	43	70
(iii) Improvement of commercial fishing	343	142	44	111	46
(iv) Fish and fishing product utilization	336	139[c]	22	60	115
(v) Fishery regulation and administration	796	93	14	578	111
Total	2 661	1 107	86	1 008	460

a/ 548 extension workers

b/ 163 extension workers

c/ 100 extension workers

Source: Expanded Fish Production Programme, FY 1972/73. Philippines Fishery Commission (30)

The number of extension workers for fish culture is based on the present aim of providing 1 extension worker for every 50 ha of ponds. This seems to be a sensible basis on which to work, other workers have suggested as high a ratio as 1 extension worker for every 10 ha, this should certainly not be necessary under the conditions found in The Philippines. The estimate of 54 to be trained every year makes allowance for some wastage and promotion.

Training facilities at present available

Fisheries education and training has a much longer history in The Philippines than in most of the other countries of southeast Asia.

The College of Agriculture offered courses in fisheries subjects in 1930 and by 1936 the University of The Philippines was offering a four-year degree course in the Science of Fisheries (32). The majority of the senior administrators and research workers of The Philippines Fisheries Commission and many senior educators are graduates from the University of The Philippines which has had a College of Fisheries since 1947. There are now a total of four colleges which offer either a four-year degree course or a two-year diploma course. The College of Fisheries of the University of The Philippines offers training in both freshwater and marine topics; the College of Fisheries of Mindanao State University at present offers a course in inland fisheries but plans to open a marine section soon, and there are colleges of fisheries in the provincial universities of Pangasinan and Bicol. The consultant was able to visit only the University of The Philippines.

The numbers of graduates produced annually are small but until recently appear to have kept pace with the demand. The University of The Philippines produces about 5 graduates at the bachelor level and about 10-15 graduates annually and the other colleges rather fewer. Some of the fisheries schools also offer courses at diploma level. The first two years of the degree course are common with other scientific disciplines such as agriculture, in the third and fourth years students specialize. In the University of The Philippines, for instance, there are options of marine fisheries, inland fisheries and fisheries technology. Full records of the types of employment taken up by the graduates were not available to the consultant. It would appear, however, that the majority join the PFC or become tenders.

The University of The Philippines has recently acquired a 190-GT, 30-m combination fishing vessel fitted out for trawling, purse seining, tuna longlining and gill netting. The ship has an air-conditioned laboratory and accommodation for 28 students and a crew of 19. Two stations for research and training in fish culture are under construction, a 40-ha brackish-water station at Leganes, Iloilo, and a freshwater station of 10 ha at Munoy, Luzon. When all these facilities come into use, the College of Fisheries will, for the first time, be able to offer a full course of practical training in marine and inland fisheries but will still be poorly equipped for practical training in fisheries technology.

Secondary education is offered in vocational as well as academic highschools and there are now 57 fisheries highschools; these are run by the Bureau of Vocational Education of the Department of Education. It is understood that the Bureau is to be replaced by a Bureau of Secondary Education. The number of fisheries schools has expanded rapidly in recent years and this expansion has placed a financial burden on the Bureau of Vocational Education. The development of school sites remains a major preoccupation of many new schools (31). The consultant was able to visit only three schools, the Pangasinan College of Fisheries, the Naic Highschool and the Iloilo Regional Fisheries School.

All of the schools offer four-year courses of secondary education, four of them also offer two-year courses at college level leading to the award of a diploma (similar to the courses offered by the universities). The secondary courses are intended to give a solid grounding in normal academic subjects as well as in the specialization chosen from fish capture, fish culture or fish preservation. Such information as is available suggests that a relatively small proportion of the graduates from these schools enter fisheries occupations and that the schools function at least in part as general highschools. In the school year 1971/72 enrolment in fisheries schools was 13 765 or 11.7 percent of the total enrolment in vocational schools (32).

The training and extension service staff of the PFC was established by Special Order No. 73 of 1973 dated 6 February 1973. The order specifies that the staff shall:

(i) supervise and adminster the fisheries extension service and training activities of the Bureau of Fisheries;

(ii) develop, plan and administer a continuing training programme for all levels and categories of staff and fisheries workers of the Bureau of Fisheries;

(iii) initiate the formation of policies, set training standards, make periodic studies to determine training needs;

(iv) develop and prepare indigenous training materials to facilitate training;

(v) set up evaluative measures and follow-up to determine effectiveness of training; and

(vi) perform such other tasks as may be assigned by the Director of Fisheries.

Although the service had been in operation for only a few weeks at the time of the visit, it was already active, had held some courses for government extension workers and was planning others. Thus, the foundations for an extension service have been laid.

A Fishermen's Training Centre will be opened in 1973. This is a four-year FAO/UNDP project to train fishermen for the offshore fleet. The site at Cavite base near Sangley Point some 30 mi from Manila was being prepared in early 1973 and the centre was then planned to open late in 1973. The project will have two vessels, a 104-ft combination purse seiner/trawler and a 50-ft combination vessel able to fish pole and line as well as trawls and purse seines. The intention is that the centre will offer courses lasting about three months to fishermen trainees then the trainees should return to the fishing fleet. The annual throughput is expected to be about 120 fishermen. There are also plans to use the centre for training of fisheries school teachers and extension workers.

Future training needs

The Philippine Fisheries Commission's plans for the rapid development of the fisheries of The Philippines will succeed only if a sufficient number of people can be trained to meet the proposed time scales. As Table 4 shows it is intended that 460 additional personnel should be recruited by the PFC in fiscal year 1973; all will require some degree of training. The training of this group, for which the new extension service will be largely responsible, must have high priority. Of equal importance is the continuation of the training of existing members of the extension service. The training of deck and engine room officers for the commercial fisheries should be considered as second priority in the immediate future although it will obviously take first place once the training of the new intake for the PFC is completed. In last place, because the extension service is not yet fully trained, are the pond operators and municipal fishermen.

The training of in-service extension workers has already started with a series of courses given by the headquarters staff of the service. The programme has started on a small scale so that experience can be gained and will be stepped up as this experience is acquired. The courses at present planned are designed to give staff knowledge of particular techniques in fish and seaweed culture and fishing. Courses will also be needed in the care and maintenance of boats and engines, fish handling, preservation, processing and marketing and in the operation of cooperative societies. Good use is being made of the volunteers, some of whom were given orientation training by the PFC. The foreign experts who will serve at the Fishermen's Training Centre will spend relatively little time in The Philippines; it is very important that full advantage be taken of their expertise while it is available and that some extension courses should be given at the Fishermen's Training Centre. Obvious subjects would be the use and maintenance of electronic fish finding and navigation equipment and various aspects of fishing gear technology.

Careful thought should be given to the future of the 57 fisheries schools to establish their exact role. It appears that it is at present intended that the schools should provide vocational training for people who will work as fishermen, fishpond operators or fish processors and also preliminary training for the few who go on to higher studies in fisheries subjects. According to a recent survey, only 14 percent of the graduates from the fisheries schools enter the industry. If this is so it would seem that something is seriously wrong with the system. There is no point in giving an expensive training in fisheries to people who really want an academic course. If there are 500 000 fishermen and 150 000 pond operators and if the average working life is 40 years then some 16 250 persons enter the fishing industry every year. Fourteen percent of an annual enrolment of 3 500 would be 490. So, if these figures are correct, less than one person in 32 is getting the training intended for him. One of the things obviously wrong with the schools is that they are quite inadequately financed and equipped. One principal reported that the annual budget for his school was P.Ps. 222 000 (U.S.$ 34 153) of which P.Ps. 200 000 (U.S.$ 30 769) represented staff salaries. U.S.$ 3 400 is not an adequate sum with which to provide books and equipment for a school with an enrolment of about 450. Not surprisingly the school had no scientific equipment, no boat other than a "banca" and few books.

The schools visited were adequately staffed, some indeed overstaffed (7 teaching staff for 42 fisheries students) but salaries are very low. Kvaran's view (31) was that only 5 of the schools had appropriate boats.

It is possible that all vocational highschools will be converted to comprehensive schools offering a 5-year course, of which the first 3 years would be common and the last 2 years preparation for an academic or vocational course. This would be a sensible arrangement. The technological needs of the fishing industry could be well met by one really good technical institute in addition to the College of Fisheries of the University of The Philippines. If this proposed change does not take place it is suggested that one of two courses should be followed. Either the schools, which are at present inadequately equipped for fisheries training, should convert to normal academic schools or they should be properly equipped for fisheries education and training. If a school is well sited and properly equipped it should be possible for it to become self-financing to a major extent. This would certainly be true for a school possessing a large area of land suitable for Chanos farming and it is the Chanos farming areas which are most likely to benefit from the presence of a school. Even a school which has to rely on marine fishing should be able to achieve a reasonable degree of self-sufficiency if it is sited close to good fishing grounds and there is not much point in siting such schools elsewhere.

Any school should, of course, be able to demonstrate that what it is teaching is commercially viable and should have sufficient boats or fishponds or both to do this. It is suggested that only schools which can be brought up to a standard where they can demonstrate at the commercial level should be retained as fishery schools and the others should become academic schools. A fishery school must, of course, be properly equipped at the outset if it is ever to become self-supporting.

It is desirable that a very clear distinction should be made between the academic schools and the fishery schools so that it is obvious to all that the fishery schools are training for the fisheries industry. If the schools are retained, this distinction should be made by returning the schools to The Philippines Fisheries Commission which formerly controlled them. This would have the further advantage that it would become a simple matter to transfer staff from the commission to the schools and vice versa. At present the best teachers, whose pay does not recognize their technical qualifications, tend to leave the schools for the commission whenever the opportunity offers because salaries are a little higher there. If the teachers were commission staff, they would be on government technical rather than teaching scales and exchange between teaching and technical posts would be uncomplicated. Such exchanges are very desirable because this makes the best possible use of available skills.

If the schools are retained as fishery schools, certain deficiencies should be remedied. The libraries should be brought up to a reasonable standard. About 300 reference books on fisheries technical subjects and about 2 000 more general works would be the minimum for a school of about 400 pupils. Many of the reference books should be available in six or more copies. Where fishing is taught, each school should have a sufficient number of boats appropriate to local conditions and fully equipped for fishing the gears used locally (and any other suitable for introduction). The schools should be able to have about one third of their pupils at sea at any one time, i.e., if there are 60 pupils on the fishing course, vessels are needed with 20 places. Some schools might earn revenue by arranging for the pupils to construct fishing gears for sale. Where fish culture is taught the school should have an area under ponds at least sufficient to provide a living for a family, the area required depending on the site and culture method used. A much larger area is needed if the school is to earn sufficient revenue to become self-supporting. Such schools should also have the equipment necessary to give students the scientific background to culture techniques. This would include microscopes for plankton and dissection work, analytical and rough balances, hydrometers, soil and water testing sets, drying oven, small centrifuge and colorimeter for pH, oxygen and carbon dioxide determinations as an absolute minimum. The minimum equipment for teaching fishery technology, which was not available in any of the schools visited, would be: domestic refrigerator and deep freeze and cooking stove with set of cooking pans; smoking/drying kiln; salting and fermentation tubs or vats; insulated fish store and ice making machine; analytical and rough balances, oil immersion microscope; laboratory oven; pressure cooker; incubator; glassware for microbiology and proximate analyses. Audio-visual aids, such as overhead and slide projectors would be immensely useful in all the schools.

The Philippine Fisheries Commission will require an average of rather more than 50 graduates a year for extension work for at least the next ten years. A small number of graduates will also be needed for teaching and in industry. It is suggested that the aim should be to produce 80 graduates a year, even with careful selection of students 25 percent wastage is likely so 100 a year should enter training. The University of The Philippines should be able to produce 40 graduates a year and the other Colleges of Fisheries the remainder. There is also a need for rather more than the 5 or so BS graduates in fisheries a year being produced by the University of The Philippines. The university now has an excellent training vessel and will shortly have the field facilities it needs for training in brackish water and inland fish culture. The technology laboratories should be re-equipped also. The most essential items would be cold rooms operating at 0°C, -10°C and -30°C, a small blast freezer, laboratory refrigerators and cold storage cabinet (-15°C), a pilot scale smoking/drying kiln, pilot scale canning line, dry salting, brining and fermentation vats, small quality control laboratory, recording and non-recording probe thermometers (-50°C to 100°C), recording hygrometers, hydrometers and anemometer.

The new extension service has got off to a good start. All the officers new to extension work will need training in extension methods and the use of audio-visual aids. A workshop which the more senior could attend would be very useful at this stage.

Summary

1. The municipal (artisanal) fisheries are of great importance to The Philippines both as a source of food and in providing employment. Much has already been done to modernize these small boat fisheries; their further development will depend on the effectiveness of the recently established extension service.

2. The extension service is presently engaged in training staff of the PFC. This should continue to have first priority.

3. Second priority should be given to training deck and engine room officers for the commercial fisheries.

4. Training for the municipal fisheries and pond operators must occupy last place solely because it will take time to train the staff for the extension service.

5. The future of the fishery highschools should be given careful thought. There are too many such schools and few are able to give the education intended. It is suggested that the majority should become comprehensive schools. If this course is not followed, only those schools which can become self-supporting should remain as vocational schools, the remainder should become academic highschools.

6. The university and fisheries colleges should be able to produce all the high level graduates needed by industry and government in the immediate future. All require some improved facilities and equipment.

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APPENDIX

The role of fisheries extension services in fisheries development

During the course of his assignment the consultant became aware that some senior officials were not familiar with the concepts and duties of a fisheries extension service. Since all the countries visited have important artisanal elements which can be reached only through an extension service this brief account of the ways in which such a service may operate has been prepared. It relies heavily on Japanese experience, the state of fisheries development in southeast Asia is now similar in many respects to that reached in Japan when the idea of a fisheries extension service was first mooted there. Local experience with agricultural or other extension services is, of course, also relevant.

Fisheries extension services were not established in Japan until after the second world war. The fisheries administration, the research facilities and experimental stations were strengthened in 1948. In 1950 a recommendation was made to government which read: "In fisheries, the research system has been fairly well established but the extension system to propagate the results of research leaves much to be desired. Application of results of scientific research to fisheries is urgently required in view of the importance of the fisheries industry in the national economy. At the moment, no proper extension system exists and the work is carried out by research workers of the fisheries experimental stations in addition to their research work. The establishment of a fisheries extension system, separate from but in close contact with research work, is therefore urgently required". The proposal was accepted by government and a budget was prepared for 1951, this was not accepted and it was not before 1953 that a budget was approved by Parliament and the service came into effective operation. Even then the appointment of extension workers was not approved, the responsibility for extension work remaining with the experimental stations; the budget did provide, however, for the employment of 69 technical specialists (university graduates of three years experience with prefectural governments or experimental stations). The delay in establishing a fisheries extension service may be attributed to the idea then prevailing in government that fisheries were different from other primary industries, such as agriculture and forestry in that the improvement of fishing techniques, such as fishing methods and gear, would lead to excessive exploitation of fishing resources.

However, it was gradually recognized that restrictive measures could not bring development of fisheries and increased welfare of the fishing communities. There was much room for the introduction of modern fishing techniques and to improve the management of enterprises without detrimental effects to resource conservation. There was also a great possibility of improving culture techniques to increase fish resources and of rational utilization of fish by improving fish processing, handling and marketing techniques. The fisheries extension service was recognized also as a means of improving living standards of people in the fishing communities.

The 69 technical specialists included experts in such fields as fish culture, engineering, equipment and electronics. After several years experience it became apparent that the service would only become fully effective if extension workers could be stationed in the fishing villages so as to identify the problems of the fishing communities by daily contact. This principle became the established method of operation for the fisheries extension service, the number of people involved in extension work being gradually increased so that by 1968 there were 105 specialists and 460 extension workers. The minimum qualification for an extension worker is three years experience with a prefectural government following graduation from a senior highschool. The fishing villages in Japan were divided into extension districts each covering approximately 500 fishing households, this is also roughly the area covered by 5 cooperative societies. At first it was usual for each extension worker to work by himself, with the improvement in roads and transport that has taken place it has become easier to move around between the villages and to arrange for several extension workers to operate in one extension district when this is desirable. This has also made it possible for the extension workers to become more specialized in particular techniques

and to use their knowledge in several districts. Extension workers are provided with motor cycles to enable them to travel freely. A number of home economics extension workers, all women, are also active in the fishing villages in Japan working with the wives of fishermen to improve living standards. It is interesting to note that the success of the extension service in Japan has led on to the establishment of a number of regional fishermen's training institutes.

The Japanese Fisheries Agency in a paper (13) published in translation by Miyake in 1966 defines the objectives of the fisheries extension in Japan as being to raise the productivity of the fisheries, to rationalize the management of fishing enterprises and to improve the standard of living of the fishermen and their families. In the extension service, the initiatives of the fishermen are considered a process of involving fishermen by living and studying together with fishermen rather than teaching them. In other words, the duties of the extension workers are to help fishermen to study themselves and solve their own problems.

The Japanese fisheries extension service has, obviously, proved to be a very effective means of improving the productivity and living standards of the artisanal fishermen and many of the lessons learned in the formation and operation of the service in Japan could be applied in other countries which do not yet have such an effective service. While conditions differ from one country to another and indeed may be very different in different parts of the same country, as for instance, where monsoon conditions are experienced; where islands of very different sizes exist; where the continental shelf is broad or narrow and where fishermen of different cultural or religious groups are living in close proximity to one another or in isolation, it can be assumed that an effective fisheries extension service could become the most important element in the improvement of the artisanal fisheries.

Perhaps the first point to be made is that the extension service should be organized at the national level. The basic principle of the service is the employment of extension workers at the village level. Such people must inevitably be trained as generalists rather than as specialists; this means that their skill and knowledge in any particular subject will be limited and will often be rather basic. They should be so trained that they can identify the need for a particular kind of expert assistance and know where this can be found. Thus, the service as a whole must be able to draw on the expertise and experience available in various branches of the Fisheries Department, other departments of government, the Research and Experimental Station, the universities and the fisheries training institutes and schools. Cooperation from these organizations would be best assured by central control; the fact that the service would have to be financed from the national treasury also argues for central control.

Since the Fisheries Department are responsible for fisheries development it follows that the fisheries extension service should be a branch of the Fisheries Department. This would also provide for one of the essential requirements of the extension service; that those employed should work on a full-time basis, it would also help to provide a career structure offering the possibility of promotion within the extension service or into other branches of fisheries work.

The fisheries extension branch should be responsible for:

(i) preparation of an annual budget and control of this;

(ii) recruitment of extension workers and specialists;

(iii) training of extension workers and specialists;

(iv) organization of courses of training at the national level for fisheries operatives;

(v) liaison with other organizations and institutions;

(vi) preparation of extension materials, such as books, pamphlets, films and radio programmes; and

(vii) an annual assessment of the effectiveness of the various aspects of the work of the extension service.

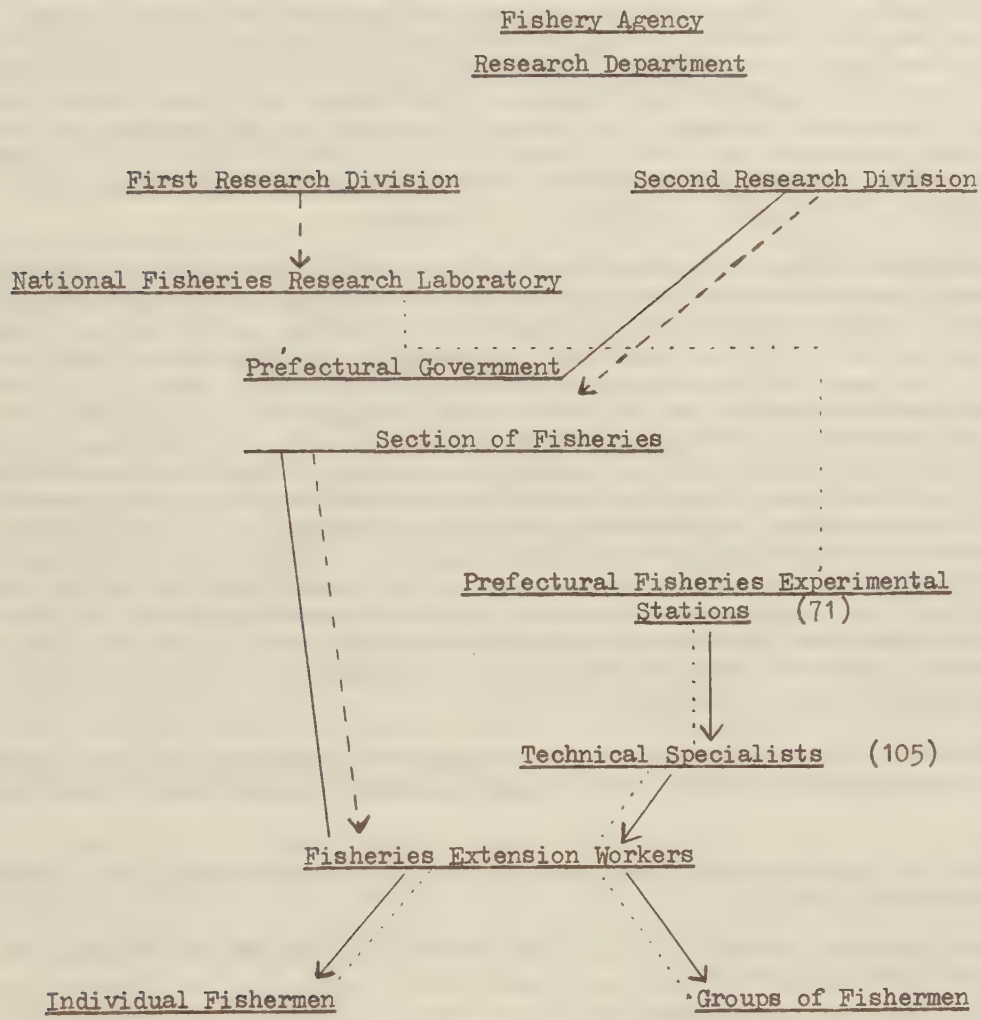
Under the Japanese system the field extension workers are backed up by a corps of specialists who provide advice and help to train the extension workers and keep their knowledge up to date. Yasueda suggests (12) that there should be at least one such specialist to ten extension workers, in fact, at the time that he wrote there were 105 specialists supporting 460 extension workers. His organizational chart (Fig. 1) shows that the technical specialists are employed in the prefectural experimental stations which are administered and supervised by the First Research Division of the Fisheries Agency while the fishery extension workers are supervised by the Second Research Division. This suggests that it is not essential to employ specialists directly in the extension service; it is, in any case, desirable that the assistance and advice of any employee of the Fisheries Department should be available to the extension service as and when it is needed. Since the number of specialists which a fisheries department can employ is limited by financial considerations the best compromise might be to employ a very small number of specialists in the extension service, even this could be unnecessary so long as the technical specialists employed in other branches of the department understand clearly that it is an essential part of their duties to provide advice and assistance to the extension service. The ways in which extension services might be organized and administered in the countries covered by this report are discussed in greater detail under the country chapters.

The second point concerns the field level organizations of an extension service and the ways in which an extension worker should carry out his tasks. He must obviously live among the fishermen so that he is in close contact with them and can develop an understanding of the pattern of life in the community. He must learn the local conditions regarding how fish is caught or cultured, how it is processed and marketed and how these operations are financed and how the profits and earnings are used. The first task of any extension worker newly appointed to a particular area should thus be to prepare an inventory of the capital equipment available (including the human resources) and the ways in which these are used. At the same time he should note obvious deficiencies in the infrastructure such as lack of port facilities, communications, transport and markets as well as noting what particular skills are present or absent in the community. He will only succeed in his job if he can gain the confidence of the community in which he is to work, he should therefore be on the look-out for any obvious deficiencies which can be quickly and easily remedied. Examples of these might include the placement of leading marks or lights in the approaches to the landing point or the marking of a known hazard to navigation, improving the supply of engine spares, making dental, medical or pre and post-natal facilities available on a regular basis, improving the supply of bait, ice, salt or fuel, improving marketing or storage facilities. Whatever is chosen must, of course, be something that the community expresses need for, not something which the extension worker feels might be useful.

The extension worker will only be able to perform his duties effectively if he is fully accepted by the community as someone who has their interests at heart, someone whose sole concern is the improvement of the community. He must, therefore, not be burdened with other tasks, more particularly he must not be expected to combine statistics collection, licensing, enforcement of regulations or inspection and control functions with his other duties (14). In many fisheries departments the junior and middle level staff wear uniform, where this is so the extension service officers should wear a uniform which distinguishes them from officers performing regulatory and control functions or permitted to wear mufti and draw an allowance in lieu of uniform.

Once the extension worker has obtained a good working knowledge of the communities for which he is responsible and has established good relationships with the members of the community he should identify the most important and urgent problems in consultation with the community and work on these. In some cases he may be able to find solutions himself, in other cases he will need to seek the help of colleagues or workers from other departments or commercial interests. Sometimes the answer to a particular problem will already be available since a similar difficulty has arisen elsewhere and been solved. Sometimes no answer is readily available and research is needed to provide the answer, the extension worker is thus an important link between the research stations and the communities.

Organizational Chart of the Fisheries Extension Service in Japan



..... Technical advice

_____ Extension and education

- - - - - - Administration and supervision

In consultation with the members of the community the extension worker should plan a programme of work at least one year in advance; where problems which will obviously need a long-term solution exist the programme may well look two or three years ahead, the programme should include possible means of solving the problems and should be agreed with the extension worker's superiors since they may be able to suggest alternative solutions and must, in any case, be aware of the budget that may be needed to see the plans through and of the calls that may be made on other staff. The plan should include the problems which most urgently require solution but within these there should be a list of priorities and the worker must also be prepared to tackle unforseen matters on an ad hoc basis whenever these arise. Those in charge of the service should require that the field staff submit regular reports on the progress achieved on new problems that have arisen and on any other matters of interest in the area in his charge. There will be failures as well as successes and the reasons for both must be assessed and analysed; the service as a whole should adopt a flexible outlook and be prepared to modify and change its plans as this becomes desirable. A list of national objectives would be a useful guide to the individual worker; if a number of districts can all work on the same aspect at one time the provision of literature is easier and can be backed up with radio or television programmes.

Sometimes the extension worker will be able to give advice to individual fishermen by making personal contact, sometimes contact may be by letter or telephone, it may be necessary to visit a work site or it may be possible to give advice to a caller at the office. More often the extension worker will make his contacts by arranging a meeting with a group of fishermen, this will often mean that his working hours will not be those normally followed by government officers, he will have to be prepared to work at night or on holidays. Two most effective ways to give advice are to arrange demonstrations, e.g., of a fishing or processing method not in use in a community or to arrange a study tour to an area where other techniques are used. Full use should also be made of audio-visual aids such as circulars, pamphlets, leaflets, posters, radio programmes, television programmes, films and district shows or fairs. Such aids are by no means to be considered as a substitute for personal contact, this is the essence of good extension work and in illiterate communities only certain audio-visual aids will be suitable. The most effective contacts will often be with groups rather than individuals but the careful extension worker must weigh up all views before proceeding with a project and should remember that some men will welcome an opportunity to voice an unpopular view in private.

A list of projects with which an extension worker might be concerned is almost endless since these may cover every aspect of life in a fishing community, among others these may include:

- improvements in existing fishing gears, perhaps by the introduction of new materials or use of more modern designs;
- introduction of winches, power blocks or other mechanical devices to reduce crew numbers and increase profitability;
- introduction of new fishing methods;
- improvements in preservation or processing techniques;
- introduction of new preservation or processing techniques;
- improvements in handling or marketing methods;
- improvements in port or landing facilities;
- providing advice on maintenance of boats or engines or other equipment;
- improving culture methods;
- introducing new culture methods;
- introducing the elements of cooperation, such as group purchase of supplies so as to obtain these at better prices, cooperation in marketing and self-help projects;

- improving facilities for maintenance of equipment, e.g., by establishing an engine repair shop;
- improving schooling and training facilities and assisting with career planning for the communities' children;

  improving medical facilities;
- assisting fishermen in their contacts with local or central government, helping them with such matters as form filling or letter writing and explaining decisions of government officials;
- where conflicts of interest occur as where fishing grounds are shared, bringing the parties concerned together to achieve agreement;
- introducing new vessel designs or building methods;
- improving housing, roads, lighting facilities;
- providing electricity, piped water, meeting room, games rooms, libraries, crèches.

The extension worker will have to be prepared to work long and irregular hours and to live in places where facilities are little developed. These difficulties should be recognized by his employers and rewarded by higher pay scales than those given to workers in urban areas. If this is difficult or impossible the rural extension worker should be given regular travel paid leave for himself and his family.

The very range of tasks which an extension worker may undertake explains why his training be as broad as possible. If he were to work only as a specialist in fishing techniques or processing he could be trained as a specialist in these subjects. In many instances, however, his primary role would be to discover the need for improvement in a particular field or to recognize where improvements might be made. He should thus be a generalist who is trained to a level at which he can understand the possibilities and limitations of the various technologies and know when to call for specialist assistance or bring a problem to the attention of the research workers. In Japan the minimum qualification for an extension worker is that he be a graduate from a senior high school with a number, usually three, of years experience in government fisheries service, research or education. The fisheries technical specialist employed in Japan must be a university graduate and have a minimum of seven years experience in extension work, research or education. Both the generalist and the specialist sit for qualifying examinations which test their powers of leadership and personal qualities as well as their technical ability.

In Japan children start their primary education at the age of six, senior high school students normally graduate at the age of 18, i.e., after 12 years schooling, there are also post-graduate courses in the senior high schools which require a further two years attendance, an alternative for the senior high school graduate is to proceed to university where the courses for a first degree last for four years. Even at the senior high school level students specialize in fishing, fish processing or marine engineering, specialists in fish culture have usually received at least a college education. It should be noted, however, that the senior high schools give a very general and liberal education, the degree of specialization offered at this level is limited. Twelve years education of which at least the last two years has included some specialized training in fisheries subjects seems also to have met the needs of the East African countries, where high school leavers, who have had about 10 or 11 years education enter training institutes where they spend two years studying fisheries matters. Similar courses are followed by those who are to become extension workers in agriculture or veterinary services.

Thus far we have been concerned only with the extension worker at the village level although we noted in passing that the extension worker should be able to call on the expertise of all the officers of the Fisheries Departments and indeed other arms of government. This requires that all members of the Fisheries Departments should have an understanding of the aims and objectives of the extension service: it also implies that all the officers are adequately trained in their specializations and duties. In the countries we are con-

sidering the service should be organized at the national level so that there can be unification of objectives and proper control of the budget, the service must obviously be controlled by the fisheries departments which are charged with the responsibility for improvement and control of the fisheries. In Malaysia, The Philippines and Thailand the fisheries departments are also organized at the state, regional or provincial level. Obviously the officers who are in charge of the state, regional and provincial departments should be adequately trained.

It is thus necessary to consider the training requirements at the fisheries officer level as well as training at the extension worker level.

In recent years there has been a considerable expansion in the fisheries activities of all the countries studied and this has required a considerable and, in some cases, massive increase in the size of the fisheries departments. At the same time there has been an increase in industrial and commercial activities so that there have been more jobs available at the graduate level than candidates able to fill these. The terms of employment in government are rigid whereas in the private sector these can be fluid and where there is competition for educated staff, government is at a disadvantage. This has led to a rapid turnover in senior staff and it has sometimes been necessary to place new graduates in responsible positions in the field with no prior training. Such stop-gap measures are inefficient and make the problem worse. A new graduate inadequately briefed on his duties and faced with a bewildering array of problems, many of which would require years of patient work for their solution, becomes discouraged and looks around for other employment, the cycle is then repeated. More junior staff lacking adequate and informed guidance also becomes discouraged and leave the service.

In discussing the subjects in which a fisheries officer should be trained Hall (15) remarks: "Senior personnel in this category need to be conversant with a vast array of potential problems. It is regarded increasingly as immaterial precisely what first degree is taken, although it is becoming more important that this should be a science degree, provided there is additional broad training in order to appreciate the complexity of the biological, technological and socio-economic problems, and when they arise, to give the problems their right degree of priority.

Traditionally, fisheries officers and assistant fisheries officers have been zoology graduates, and there is advantage in having such a natural science training for the first degree. Additionally, however, such officers must have a specialist knowledge in oceanography, fisheries biology, the biological basis of fisheries legislation, the general principles of fisheries research, the design, construction and repair and operation of a wide variety of fishing gears, elementary navigation, fishing boat design and construction, inboard and outboard engine operation and maintenance, fish processing, storage and handling, principles and practice of cooperatives, and fisheries economics". One might add a number of other subjects to this list, where fish culture is of importance this should be included and of course the officer also has to learn the details of local legislation, licensing practice and statistics collection, as well as general government procedures.

Since the numbers of officers in this category in any country are relatively small it is impractical to attempt to provide the full training needed at the national level, it would indeed be difficult to provide this at a regional level. There are considerable advantages to be gained by carrying out training at this level in a residential school in a country having a relatively advanced fishing industry. Specialist staff having a wide range of technical equipment at their disposal can be employed and the students can be given the opportunity to study fisheries in a more advanced stage of development than those in their own country or region. The students would gain more from the course if they have been employed in a field post in their own country before proceeding to the course since they would then have some understanding of the nature of the tasks before them on their return. This does not mean that they should be given full administrative responsibility before they are trained, they should be given an opportunity of understudying a senior officer and then receive training, this should reduce the wastage that has occurred in the

recent past. This would seem to require that the fisheries departments establish a small number of supernumerary posts to provide for their training needs. As the cadre of fully trained and experienced officers is built up so the requirement for supernumerary posts would be reduced; but one or more posts should be retained to allow for replacement of officers who reach retiring age, or leave the service early for other reasons.

It would, at present, be impractical, if only for financial reasons, to consider the employment of numbers of technical specialists at the state, regional or provincial level. The fisheries officers in charge should be able to provide some advice to extension workers, other sources of advice would include:

(i) the specialists such as naval architects, fishing gear technologists, fish processing technologists, marketing experts and economists employed in Fisheries Department Headquarters;

(ii) the specialists employed in other government departments at the national or local level including marine surveyors, marine engineers, harbour masters, social science, medical and health workers, food technologists, nutrition experts, etc.;

(iii) the research branch of the Fisheries Department;

(iv) local, national and regional fisheries schools, colleges and training institutes;

(v) the universities;

(vi) commercial interests, such as net factories, marine engine and electronic equipment distributors and sales agencies;

(vii) the international agencies, especially FAO;

(viii) agencies providing technical assistance on a bilateral basis;

(ix) fisheries departments, universities, research and training establishments in other countries.

All those involved in extension work should have ready access to a well stocked library and have an opportunity to see the many excellent fisheries journals which are now available. Such facilities are at present inadequate or completely lacking in the state, regional and provincial offices which the consultant visited and even in some of the schools and other training establishments.

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